THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXIX. No. 18. Whole No. 1,482. | NEW YORK, MONDAY, NOVEMBER 2, 1903. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, New York.

Telephone.—2996 John.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $5 (£1—25 francs). All payments to be made in advance. Single copies, 10 cents.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Collections are invariably made directly from this office for subscriptions advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C. O. D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

EDITORIALS—

Briefly Told..... 681

The Finals of the American Meeting—Notes.

Address of the President of the American Gas Light Association (Mr. Alten S. Miller, of Baltimore, Md.), on the Occasion of Its Thirty-first Annual Meeting, Detroit, Mich., Oct. 21, 22 and 23, 1903..... 682

Some Features of Municipal Ownership, by Mr. Henry L. Doherty, New York City..... 684

*Notes on the Operation of Large Carburetted Water Gas Sets, by Mr. W. C. Morris, Long Island City, N. Y..... 689

SPECIAL ENGLISH CORRESPONDENCE..... 691

Gas Works in Scotland—Save the Ashes—Some Large Gas Engines—The Erratic Arc.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 692

Personal—Col. Copley's Clever System of Extending—Municipal Ownership, Ashtabula, O.—The Canadian Oil and Gas Company—Annual Meeting, Troy, N. Y.—Dr. Darrin, of the American Tar Company—Something from Baltimore, Md.—Mr. Jas. M. Hadden in a New Field—A Chapter from Beaumont, Tex.—Roxbury, N. Y., Wants a Gas Works—The St. Louis County (Mo.) Gas Works—Annual Meeting, Albion, Mich.—And Other Items.

Why Staybolts Break..... 694

The Market for Gas Securities..... 694

BRIEFLY TOLD.

THE FINALS OF THE AMERICAN MEETING.—Little remains to be said regarding the Detroit meeting of the American Gas Light Association in addition to that which was contained in our despatches last week, for those fairly well recounted the proceedings. It was a remarkable meeting from many points. The arrangements for its conducting could not have been excelled, the Committee of Arrangements working well in harmony with the Association's executive officers for the comfort and pleasure of all. In fact, it is said without any thought of demur that the domestic conditions could not have been surpassed—if one may use the word "domestic" in such sense. The outing on Friday was like the harmonies of the two preceding days, and the following lines respecting it are from one who shared its pleasures:

"Dear JOURNAL: What shall I say of the boat ride on the last day of the meeting? So many nice things were said by so many nice people that I'm at a loss where to begin. The day was rather cold, but everyone seemed prepared for any sort of weather, so no complaints were heard on that score. The start was prompt, and 350 guests were on board when our pilot gave the word. The first stop was at the works of the Detroit Stove Company, where an interesting half hour of inspection was spent—cigars for the smokers and clusters of chrysanthemums for the ladies were liberally placed. A sail over the waters of Lake St. Clair, sufficiently 'out-to-sea' to go through a flurry of snow, followed; but the rawness of the air and the flaky dampness of the snow were soon wiped out by the warmth of our welcome and the beauty and hospitality of our entertainment at Walkerville, on 'the other side of the border.' Never in the history of entertainments of this kind tendered the gas fraternity has the writer (and I may claim myself a veteran) seen so perfect a luncheon service. A host of 350 is a pretty 'big bunch' to drop into a business place to be catered to, but Messrs. Hiram Walker & Sons were equal to the occasion. And right well did they merit the neat little speech turned off by Mr. William McDonald, in acknowledging their courtesies. Mr. Robinson happily responded for the Walker Company, and the rousing cheers that hailed the ending of his speech about expressed the real sentiments of the voyagers. Our next stop was at the plant of the Solvay Company, after which the return was made to the starting point in good season. An excellent band was on duty all the time, and those who did not care to dance, as well as those who did, had no difficulty in finding where excellent refreshments could be had. Again Mr. McDonald offered a hearty vote of thanks to the local Committee of Arrangements, and brief and pithy responses thereto were made on behalf of the Committee by 'Fat Fred.' and 'Ministerial Jim.' 'Twas a pretty good day, taken all in all. Nearly everyone left on Friday evening, and Detroit once more resumed its normal condition.—W. O."

NOTES—

MR. IRVIN BUTTERWORTH, General Manager of the Detroit City Gas Company, writing under date of the 24th inst., wishes us to say that if the lady who lost a diamond pin, at the banquet of the American Gas Light Association the night of the 24th ult., will communicate with the proprietor of the Russell House, the jewel will be restored to her.

LIBRARY OF CONGRESS NOV 2 1903 SMITHSONIAN DEPOSIT

THERE has been a change in the proprietorship of the Lebanon (O.) Gas Company, and Mr. S. M. Tittle has been appointed Manager thereof. He has been authorized to change the system of manufacture from oil gas to coal gas, and it has been planned to make extensive additions to the distributing service.

A CORRESPONDENT forwards the following under date of October 23d: "Those interested in the welfare of Binghamton, N. Y., have watched with interest the growth of the new Binghamton Gas Company, since its advent here a few years ago. Under the capable management of Mr. Fred. B. Wheeler, always on the alert for any improvement, the Company has taken every opportunity to give its many patrons the best service that attention and money can procure. There is no question that its wonderful advancement has depended upon its liberality. The Board of Directors the other day celebrated the occupancy of the Company's handsome new office building, 40 Chenango street, by ordering a sensible reduction in the selling rates, which concessions are to date from New Year's day. Under the schedule the gross rate is reduced to $1.50 per 1,000 cubic feet, prompt payment (within 10 days) to entitle the user to a rebate of 25 cents per 1,000. It is, however, stipulated that a minimum bill per month shall rule, up to certain quantities. For instance, users of 100 cubic feet per month (the minimum), are to pay 60 cents gross, or 50 cents, net; and so on, up to 400 cubic feet, when the general rate per 1,000 takes effect. The works are in good physical condition, and Manager Wheeler is my authority for the statement that more main extensions—the development in this line for the past 2 years have been of the important order—will be made next summer. The Company and its 'natty' Manager have the good will of everyone with whom they deal.—R. N."

MR. F. R. HUTTON, Secretary of the American Society of Mechanical Engineers, informs us that the next meeting of the Society will be held in New York city, according to the following programme: The headquarters will be as usual at the Society House, 12 West Twenty-first street, where the opening session will occur. Tuesday, December 1st, at 9 P.M. The President, Mr. James M. Dodge, will deliver the opening address, and he has chosen for his subject "The Value of an Engineering Education to a Young Man." The second session will occur on Wednesday morning in the hall of the Mendelessohn Glee Club, 113 West 40th street, because of the limited capacity of the Society's home auditorium. This will be the business session of the convention, and during its continuance many professional papers will be read and discussed. Following this, luncheon will be served at the Society House, and the afternoun will be spent in making excursions to various power stations and points of interest in the city. The evening of this day has been left open for members to make their own engagements. The third session will take place in the Carnegie laboratory, Stevens Institute, Hoboken, N. J., Thursday morning at 10 o'clock. Luncheon will be served at the Institute, and will be followed by visits to various points of interest in and about the grounds. The usual reception for guests and friends will be at Sherry's, 44th street and 5th avenue., Thursday evening at 9 o'clock, and will be followed by dancing and supper. The closing session will be at the Society House, Friday morning, December 4th at 10 o'clock. The Nominating Committee will present the following named gentlemen as office bearers for the ensuing year: President, Mr. Ambrose Swasey, Cleveland, O.; Vice-Presidents, Prof. D. S. Jacobus, Hoboken, N. J.; Mr. M. L. Holman, St. Louis, Mo., Mr. Wm. J. Keep, Detroit, Mich.; Treasurer, Mr. William H. Wiley, New York city.

ENTIRELY through inadvertance our telegraphic correspondence last week, concerning the thirty-first meeting of the American Gas Light Association, the re-election of Mr. A. E. Forstall to the dual position of Secretary and Treasurer was not reported.

MR. J. W. BUTNAM, formerly prominent in the management of the Decatur (Ills.) Gas Light Company, died at his home in that city, Monday, Oct. 12th. He was in his 80th year, and had not been actively engaged in business for a decade or so.

MR. A. B. JOHNSON, Superintendent of the gas division of the properties of the Equitable Gas and Electric Company, of Utica, N. Y., died at his home in that city about a fortnight ago. He was in his 44th year, having been born in Utica November 18th, 1859. Deceased had been ill for quite a while, and during his incapacity Mr. William J. Cahill had charge of the plant.

MAYOR CHAPIN, of Holyoke, Mass., seems at last disposed to go in for allowing a sufficient sum for the improvements needed on the municipal gas plant. He should have made his mind up on that point some months ago. However, better late than never.

Address of the President of the American Gas Light Association (Mr. Alten S. Miller, of Baltimore, Md.), on the Occasion of Its Thirty-first Annual Meeting, Detroit, Mich., Oct. 21, 22 and 23, 1903.

Since our last meeting there have been no startling developments in our business, though there are several matters of interest that might be touched upon.

During that meeting there was in progress one of the most expensive and serious strikes known to this country. Directly or indirectly it affected every person east of the Mississippi, from the Lakes to the Gulf of Mexico. The gas industry was especially influenced. On the one hand, it was almost impossible to get fuel that would make gas, and on the other the demand for our product was unprecedented, taxing the works and mains beyond all expectation. While the coal strike of 1902 was officially at an end before the 1st of December of last year, the scarcity of fuel was felt until June last, and the high prices growing out of the strike are still with us. While anthracite coal was selling at fancy prices, some as high as $26 a ton within 200 miles of the mines, a large amount of the Welch anthracite was imported for making water gas. It was hoped that this coal would prove a satisfactory substitute for the American anthracite, but it fell far short. It would make gas, and was far better than nothing; but it is not only unsatisfactory in the generators, but does not even make a good fuel for boilers. It is hard to kindle and is difficult to keep alight. The great demand made coke almost as scarce as anthracite, and it was not always possible to substitute the former, so it is a lasting tribute to the energy and resourcefulness of the gas industry that the supply of gas was maintained.

The coal gas manufacturer fared better than those equipped only to make water gas; but he was not free from trouble. The great demand for all fuel, and the action of the railroads in saving themselves at the expense of the shippers, made it very difficult to keep supplied.

The first thing that gas companies should do is to increase their capacity for storage, and put in sufficient coal to last at least 5 or 6 months, or probably for a year. The old practice of carrying 6 or 8 weeks' supply is no longer a safe one to follow, and for the safety of the business the coal stores should be enlarged and kept full.

The second step for the companies to take is to ally themselves with the reputable builders and manufacturers in each city for the purpose of preventing lawlessness, the restriction of output, and interference with non-union labor. The laborers and mechanics are, as a rule, good, law-abiding citizens, but are too ready to listen to the voice of the demagogue. The latter is always with us, and it is not unreasonable to expect him to use the powerful weapons which have been put into his hands by the many shameless combinations of capital which have put the cost to the consumer of so many articles of every-day use so high as to almost prohibit consumption. In this case the innocent suffer usually more than the guilty, and they must take means to protect themselves.

That some concerted action is necessary is shown by other events than the coal strike. You are all familiar with the blackmail exacted by the leaders of the trades' unions in New York. In another city the militia, which had been called out by the governor, was sent home at the request of the company because it was aiding the strikers in the destruction of property. These and hundreds of other cases show the drift towards lawlessness and the aid and comfort that the unions get from those whose duty it is to preserve the peace. A careful study of recent strikes shows further that many are aimed against individuals or single corporations, with the idea of reducing them, one at a time, until all are in a state of subjection. It is not only good policy, therefore, but necessary, that those responsible for invested capital should work together. As a force is most potent and awe inspiring when least understood, it is a great advantage to work quietly and, as far as possible, without the general public having knowledge even of the existence of the association.

Returning to the coal strike, we find it was not entirely without its advantages to the gas interests. Thousands of people discovered for the first time that gas is an ever-ready, cheap and convenient fuel, and this will not be readily forgotten. The increased price of coal, which still continues, also encourages the use of a substitute, which the gas companies of this country have not been slow in offering. The silver lining, in this case at least, is very evident, and is a source of great comfort.

Since our last meeting two installations of inclined retorts have been put into operation in this country. The make per foot of retort, on which so much depends, seems to be sufficiently high to prove this method the cheapest for carbonizing coal, interest and depreciation in-

cluded. There are in use in France and Germany machines for propelling coal at a velocity claimed to be sufficient to easily and satisfactorily charge a 20-foot resort. If this claim is made good, this will be a powerful ally for the horizontals, and may bring the latter to the front as the most economical system.

Some progress is being made in coke ovens, and a contract was recently made by a company to buy four millions daily from this source. The company furnishing this gas has an installation that contains many improvements in design, which go to cheapen the operation and reduce wear and tear, and further, has facilities for storing a month's supply of coal. The damages arising from a failure to supply the gas as agreed will be a large inducement to keep the stores well filled.

There is a continual evolution in design. The cheapening of cement has largely increased the use of concrete for foundations, retaining walls, engine settings, floors, etc. The use of conveyors and labor saving machinery is increasing. More attention is being given to economy in boilers, engines and pumps. Purifying boxes are being deepened and enlarged, and, as a whole, the gas business is easily keeping abreast of other manufacturing industries.

There seems to be more room for progress in the efficiency of lighting burners than elsewhere. The high pressure, incandescent gas burner has an illuminating power of 40 candles for each foot of gas burned. This seems high, but with an average gas having 700 British thermal units per foot, the efficiency is only 5.3 per cent. Compared with the electric arc which has an efficiency of 27.1 per cent. this looks small. The following is a table of the efficiences of the sources of light in common use:

	Per Cent.
Series arc—1 watt per candle	27.1
Inclosed arc—1.4 watts per candle	19.3
Nernst lamp—1.6 " " "	17.0
Incandescent electric lamp—3.5 watts per candle	7.75
Incandescent gas lamp—40 candles per foot	5.3
" " " 20 " " "	2.65
Open flame " " 5 " " "	.66
Oil lamp	.59

This table shows the great opportunity for improvement in the efficiency of gas burners, and, taken with the great strides that have been made in the past few years, should be full of encouragement to those interested in our business. The nearer one approaches perfection the less incentive there is to further effort; so, on the above showing, the gas people should work much harder than the electricians.

There is an unfortunate and growing tendency among those responsible for the commercial end of the gas business to push the sale of lamps containing clusters of incandescent mantles in close proximity to each other. This practice is bad from almost every point of view. The fundamental principle of good lighting is violated in that the sources of light are cencentrated instead of being scattered. Economy and efficiency in operation are sacrificed, as the effective light produced from a foot of gas is less than is the case when single burners are used. As usually constructed, one mantle of the group may be used, or all may be used together, but no intermediate number may be kept lighted at one time; therefore, they are not convenient. The best friend of this lamp does not claim it to be beautiful, so what remains? The only argument that I have ever heard in its favor is that a certain class whose taste has been vitiated by the use of electric arc lamps will buy the "Gas Arcs" when they will not buy anything else, especially as the latter can be sold slightly cheaper than a chandelier with burners and shades. As we refuse to sell or encourage the sale of cooking or heating appliances which we do not believe to be satisfactory and economical, are we not making a mistake in pursuing the opposite course in lighting appliances? It is better to lose a customer than to encourage the use of a lamp that in the long run cannot fail to hurt the gas business.

In this connection it would be proper to refer to the movement in England in the direction of reducing the illuminating power of gas. The quality of coal used and other local conditions may render such action eminently proper there, but conditions do not justify it in this country. A number of experiments indicate that a reduction of one candle in the illuminating power of the average commercial gas will reduce the heating power 3 per cent. Starting with 20-candle gas the reduction of a candle means 5 per cent. in light and 3 per cent. in heat. Assuming that the reduction does not decrease the duty of the incandescent gas burner, the advantage thus gained is more than offset by the loss in the open flame burners. If, therefore, we assume that we are selling heat alone and not light, how many companies can afford to reduce the selling price 3 per cent. in order to compensate for the reduction of 1 candle in the illuminating power? The investment will increase as the heating power decreases, so there is a double reason to keep the calorific value of the gas as high as possible.

I must again call your attention to the work of the Association itself. This has been referred to by many of my predecessors, but conditions do not seem to improve. I refer particularly to the writing and discussion of papers. Papers can seldom be secured from a member except through the intercession of personal friends, and at the meetings too few join in the discussions. During the past 4 years the average attendance has been 188 and the average number of speakers 44, or 23 per cent. The number of individuals attending during the 4 years was 393, and the number of individual speakers was 109, or 27.7 per cent. A number of those speaking were heard only once or twice during the 4 years, so that the number taking an active part in the proceedings narrows down until it is very small. This is not as it should be, and I believe that the members are prepared to do better if the subject is properly presented. Membership in our Association is valuable and should be appreciated, but the members should recognize that it carries certain obligations. A member's duties are by no means discharged when he pays his dues, and unless he does much more than this he is not carrying his share of the burden.

I would respectfully suggest that the duty of obtaining papers be delegated to the Council of the Association, or to a committee appointed by the Council. Having decided in advance upon two or three subjects for discussion, each subject should be allotted to 3 or 4 members of the Association, and each member receiving such an allotment should prepare a paper on the subject. In addition, half a dozen members should be asked to come prepared to discuss each subject. By carefully selecting the members from those favoring and those opposed to a method or system, the evidence would be more conclusive than it is at present.

I regret that more progress in the adoption and use of the street main standards cannot be reported. As no objections have been urged to the standards proposed, it is to be assumed that the members not using them are not willing to assume the small trouble and expense necessary to make the change. The members should realize that the general adoption will cheapen the cost of specials, in the long run, and on that account if on no other should put the standard in use with the least possible delay.

I respectfully recommend to your consideration the Report of the Trustees of the Gas Educational Fund, and the paper prepared by Mr. Humphreys, on the work that has been done. Each member should listen carefully to the paper and report, and should then do everything possible to help along this great, good work. Much has been already accomplished and much more will be accomplished in the future. The questions and answers, which may be found in the Prodeedings of the Association, will prove good reading for any one interested in the gas business, and there are few who cannot gain something by their perusal. If those connected with our business and who are not qualified or eligible to take up the class work, will obtain the bound copies of the Proceedings and study the questions and answers they will be many times repaid for their trouble. The work done by the trustees is directly in furtherance of the object for which our Association was formed, as declared in the Constitution, "The promotion and advancement of knowledge, scientific and practical, in all matters relating to the construction and management of gas works, and the manufacture, distribution and consumption of gas." This increase of knowledge in the end benefits every gas undertaking in the country, and in assisting in the work each company is advancing its own interests.

You have all received a copy of the Report of the Committee on Uniform Accounts. This is a splendid work, and if the system suggested is generally adopted our industry will be greatly benefitted. The Association was fortunate in being able to secure the services of three men of such unusual experience and ability. Such men are rare and their time is valuable, so we are peculiarly fortunate that they were willing to devote so much of their time to our work. Every detail of the report shows the study and care devoted to it, and it should be a lasting inspiration to every member. The members of our Association, individually and collectively, are under obligations to the members of this Committee which can never be repaid. I recommend its careful study by every member of the Association, and hope that all will use their efforts to secure its adoption by the companies in which they are interested.

We lost through death last year five of our members. A sixth, Mr. E. B. Knight, of Far Rockaway, N. Y., died June 17th, 1902, but his death was not reported to our Secretary until recently.

The gas industry and our Association have sustained a severe loss in

the death of Mr. Eugene Vanderpool. A member of the American Gas Light Association since the year of its organization, he has always worked to increase the efficiency and usefulness of the Association and to advance the interests of the gas industry. He was an enthusiastic supporter of our Correspondence Class, and was a Trustee of the Gas Educational Fund. His influence reached far beyond the gas industry, and everything with which he came in contact was thereby dignified and uplifted. It is not necessary to remind those who knew him that his loss is a personal bereavement, but for the benefit of those who were not so fortunate I wish to say that our Association has lost one of its best friends.

We miss to-day the genial face of our old friend, Mr. H. B. Leach. He joined our Association in 1882, and from that time until now he missed but one meeting. On July 25th last death claimed him almost without previous warning. He leaves a host of friends among whom his place can never be filled.

Mr. Wm. K. Park, who joined the Association in 1885, died during the past year.

Mr. Julius Buss died Nov. 23d last. He had been a member of our Association since October, 1892.

Mr. Frederick A. Welles, who joined the Association at our last meeting, died on December 16th.

Some Features of Municipal Ownership.

[A paper read at the Thirty-first Meeting of the American Gas Light Association (Detroit, Mich., Oct. 21st, 22d, 23d), by MR. HENRY L. DOHERTY, New York city.]

The agitation for municipal ownership is largely a fad, but one which is injurious both to public and privately owned municipal utilities. It is a handicap on the legitimate development of utilities which is frequently responsible for inadequate service from a geographic standpoint and poor and uneconomical service where it does exist. Some of the men who pose as the "friends of the people" in advocating municipal ownership are often sincere, although other advocates are prompted by the same motives which actuate the spider to invite the fly to his web, and yet it seems to never occur to these men that, in continually threatening private enterprises with municipal opposition, they are curtailing the credit of private business, rendering it impossible for it to secure funds on a sufficiently advantageous basis to enable it to give good and adequate service and to provide new and modern equipment which will enable it to supply service at lowest cost. This continual threat of municipal opposition has already discredited private undertakings to an extent which probably prevents many small communities from enjoying the benefit of gas and electric plants, although able to support such enterprises. Take away this continual threat of competition, and gas and electric securities will have the same value they now have at an interest rate one-third less. The politician has nothing to lose from this agitation, but the public and you, gentlemen, have. The burden of demonstrating the actual degree of success or failure of municipal ownership must, therefore, rest with you. It is a question which can be permanently disposed of by honest and determined treatment. We must give municipal ownership credit for such advantages as it enjoys, and we must not only be willing to show the shortcomings of private ownership and corporation misconduct, but we must help expose these shortcomings, correct misconduct and seek means for improvement.

If we are going to give municipal ownership thorough consideration, we must start from fundamental facts and consider questions of an elementary character.

An element of the principles of radical socialism always influences the consideration of this problem. Fully 90 per cent. of the people of this country unconsciously have socialistic tendencies, although the very large majority of them would vehemently resent being classed as socialists. If we should all share alike, regardless of ability and industry, and divide with each other and re-divide as frequently as possible to maintain equilibrium, then this argument would be a waste of time. We must, therefore, assume, for the sake of a point from which to start, that radical socialism is both impossible and inequitable.

The general dislike with which the public regards corporations is due entirely to their inability to see anything more than the real and apparently wrongful acts of corporations. They overlook the theory which gave the corporation birth, and fail to appreciate the great factor corporations have played in the advancement of the welfare of all classes, especially to the middle and laboring classes. There are certain laws of economics which are as fixed as the laws of gravity, and which cannot be changed or influenced by public will or sentiment. Some enterprises by their very nature require a large aggregation of capital to realize the economic conditions fixed by these natural laws. Labor-saving machinery must be provided, and to secure the full advantage of the division of labor operations must be conducted upon a gigantic scale. If the law did not provide for the co-operation of men of small or moderate means, these enterprises would be open only to those possessed of large means. As only the very rich would possess sufficient means, these opportunities would be open only to the few, and for lack of competition these few rich people could make these opportunities as productive as their greed might dictate, and we would then in reality have the condition of "The rich getting richer and the poor poorer." The rich man's dollar could be made to realize 40 or 50 per cent. profit, while for lack of opportunity the poor man's dollar could be made to earn but 1 or 2 per cent. But the opportunity for several or many men to combine their capital makes each one of the poor man's dollars worth just as much as the rich man's dollar, and this feature of the beneficial results of the existence of corporations is seldom recognized or given consideration by the public, due to the lack of proper thought and study, and to the prejudice that is instilled in the public mind by a socialistic press and a socialistic pulpit.

Radical socialism is an irrational plan for the division of the fruits of labor regardless of worth and merit. The opportunity for the co-operation of capital and labor through lawful incorporation not only offers a means for the equitable division of the fruits of labor, but renders possible the realization of the benefits of economic laws which adds to the productiveness of labor, capital and thought to a sensational degree. As an example of the increased production due to combination of capital to provide labor saving machinery, and to secure the advantage of an economic division of labor, it is now said to be possible for one workman to produce as large a quantity of nails, and of a better quality, than was formerly produced by 1,500 workmen.

Opportunity for co-operation by means of legal incorporation is the friend of the poor man, but of no particular benefit to the rich man. But why theorize on this point when conclusive evidence can be offered? If this position were not correct, only the rich man's son would have a chance to become a man of affairs. Nearly a generation is required for a demonstration of this example, and we cannot see a generation ahead. We can, however, go back a generation and trace history down to our present day. Who are the men of affairs of to-day? Surely they are not exclusively the sons of the rich of the previous generation. They are largely the sons of the poor minister, the farmer and the mechanic. Some of them, it is true, had rich fathers, but this does not absolutely disqualify a man if he has industry, ambition and merit. Make a list of the men of affairs, and for every rich man's son you can find amongst them, others can point out five who were born and reared in humble circumstances. This is the theory, effect and result of co-operation, which is synonymous for legalized incorporation. Is this the system that we should aim to tear down because it does not meet favor with a few radical socialists?

Admit that their motives are good, and the fact still remains that they are unconsciously attempting to turn back the wheels of progress. They say the system is wrong. Perhaps it does shield some wrongs, but surely we should aim to improve conditions and eliminate the wrongs rather than eradicate the system. Because it may be beneficial to the rich man it would not be right to deny its advantages to the man of poor or moderate circumstances. Legalized incorporation is merely a convenience to the rich man, while it is a necessity to the man or men of meager or moderate means.

What we want is further co-operation rather than the destruction of what we already have. Politicians are striving to divide the public into one class which invests and another class which works. After this division has been secured the politician and demagogue can easily work up class prejudice—in fact, he has already done so. The future of American supremacy depends, first, upon checking this class division, and then upon the amalgamation of the classes. The truest American is the man who both invests and works. A large element of the investing class is already composed of the hardest workers in the world. It only remains for more of the working class to be investors. If they of the working class can live at all in times of depression, they can, in times of prosperity, such as the period we are now passing through, become investors.

It remains only for the organizers of incorporated companies to issue securities in such small amounts as to be available for sums of money no larger than fair-sized individual savings bank deposits, and for the co-operation of those having influence with the members of the working class to induce them to become investors. With proper study of means

on the part of financiers and economists, and by honesty and proper spirit for treatment by both the investing and working classes, the interests of the two classes can be made almost identical. Participation by ownership of stock in incorporated companies is the only equitable and rational means of co-operation and profit sharing which is generally available. The masses of the American people are abundantly able to invest something in the securities of incorporated companies under proper conditions, if they have confidence in the undertaking and its management.

Municipal ownership is advocated largely on the grounds of universal co-operation. At first glance it "looks good," but after careful study it will be found to be neither expedient, rational, equitable nor desirable; while co-operation by legalized incorporation offers a rational, equitable and desirable system of co-operation, especially if it can be rendered more available to all classes. If this dream could be realized, incorporation would become a means of almost universal co-operation and a savings bank for the masses.

We are now ready to consider the wisdom and effect of a city acquiring control of public service properties. The scheme finds considerable advocacy, and if there is any reason why a city should embark upon a business enterprise such reason should not be in discord with wisdom, There also should be a satisfactory reason for selecting this particular class of a business enterprise upon which to embark.

These questions have been asked of many municipal ownership advocates; but their answers have been either too scattering, vague or illogical for any concrete impression to be obtained. Their advocacy of municipal ownership is due largely to sentimental reasons, prompted by innate socialism and dislike for corporations, supplemented by misapprehension of the profits of the business and the lack of knowledge of the disastrous results which have followed municipal undertakings in many cities other than their own. As no uniformity of opinion seems to exist on this side of the question, I will consider all of the reasons which have been offered to justify municipal ownership. They are as follows:

1. To render impossible the ownership of a public utility by non-residents.
2. To enable the plant to be operated for the greatest good to the greatest number.
3. To protect the public from fraud.
4. To break up monopolies.
5. To prevent the use of public thoroughfares for private gain.
6. To yield a profit.
7. To cheapen the cost to users.
8. To insure good service.
9. To insure equitable division of profits from municipal utilities in the interests of all citizens.
10. To insure protection of employees of all public utility companies.
11. To enable the city to have employment patronage that it can distribute amongst the needy.
12. To prevent desirable positions from being given to men imported from other cities.
13. To protect municipal officers from temptation.
14. To purify politics, raise the standard of municipal officers, and secure honest administration of all public trusts.
15. To compel citizens to take an interest in public affairs.
16. To assist in raising the standard of living amongst the poorer classes by supplying them with public service at operating cost.
17. To secure ownership by the people for the elevating effect of citizenship.

It is unnecessary to express opinions of these reasons, for they must be measured by an exact standard. When the framers of our Constitution used the phrase, "The greatest good to the greatest number," they probably thought it unnecessary to qualify the statement so that it should not crucify the fundamental law of justice; but modern municipal ownership advocates often interpret this phrase to read, "The greatest good to the greatest number, regardless of justice." For the preservation of the American people, their motto and watchword must be, "Justice." Any policy inconsistent with justice must be rejected. Their purpose and their reasons, therefore, should permit:

1. That justice must prevail.
2. That truth and experience should not be disregarded.
3. That matters of opinion should appeal to common sense.

We will take up their reasons and measure them by the standards outlined above.

1. "To render impossible the ownership of public utilities, by non-residents."

This reason is not always in accord with the third condition, "common sense." When quasi-public utilities are sold by local investors the money is generally re-invested at home. The city still has its public utility company, and the money paid for it generally goes to create or support other local industries and often to the great benefit of that particular city. This is not a guess, but a statement upon which absolute evidence can be furnished.

2. "To enable the plant to be operated for the greatest good to the greatest number."

This would not always accord with justice. Examples can sometimes be made most impressive by exaggeration. Let us assume that a city has one taxpayer and 1,000 light users. Acting upon the reason given, some people would advocate supporting the light plant entirely by taxation and furnishing light to the citizens without cost. This is simply an exaggeration of the condition which generally prevails under municipal ownership. Service is furnished at less than real cost and the taxpayers make up the deficit.

3. "To protect the public from fraud."

This reason does not meet the second condition, "truth," or the third condition, "common sense." Fraud is impossible without collusion between the manager and many of his employees, and it would be impossible for him to enter into criminal collusion with them without subjecting himself to blackmail and to loss of authority.

4. "To break up monopolies."

This reason does not meet the second condition, "Truth." The average gas or electric company can be a monopoly, but most of these companies have found that it does not pay to assume this position. A certain amount of business can be demanded and held at monopoly prices, but maximum profits can only be realized by cutting prices to the lowest possible limit and competing with every other medium available for light, heat and power. The gas and electric company which is keeping within its monopoly limit is almost a thing of the past, if not entirely gone.

That you break up a monopoly by municipal ownership is untrue. You simply change its nature and render the monopoly feature absolute. Every avenue for redress which is open to the aggrieved consumer against the city was also available against the private company, and many opportunities for redress to the aggrieved consumer which were open against the private company are not open to the consumer against the city.

5. "To prevent the use of public thoroughfares for private gain."

This reason does not meet the first condition, "Justice," or the third condition, "Common sense." That is exactly what the thoroughfares are for, and if their use is forbidden to one it should be forbidden to all. The average gas and electric company transmits annually over or under the public thoroughfares the equivalent of thousands of tons of coal. They do not injure the thoroughfares nor the adjoining property, for the transmission is not accompanied by wear and tear of the streets nor by noise. If all light and fuel were transmitted in the same manner, the city would be saved considerable street repair expense and the streets would be free from dirt and noise.

6. "To yield a profit," and (7), "to cheapen the cost to users," are almost synonymous. These reasons bring up the real bone of contention. At first glance it looks as though the city could at least save the profit of private ownership, and without further thought or investigation the average man assumes that the city could either make a profit at the same price or sell at a much less price if no profit were exacted. But the wrecks strewn along the path of municipal ownership history disprove this, and if known to the average hard-headed and practical American citizen, would offer evidence of a more conclusive character than the flowery word-pictures of the man who habitually talks, but seldom works, or the polished rhetoric of the student of economics who has so diligently studied books that he has had no time nor inclination to study men. The problem which, therefore, presents itself is the question of the relative economy of operation under municipal and private ownership. The city has the one advantage of a larger credit which generally permits it to borrow funds at a lower rate of interest. Beyond this apparent advantage, it has no other advantage worth mentioning, while the private corporation has unlimited advantages of every other character. The margin of difference between profitable and unprofitable management is not so wide but that even one of innumerable elements, which to the inexperienced may seem of relatively small importance, is easily sufficient to cause a profitable private undertaking to become an unprofitable municipal undertaking. Municipal ownership not only offers an opportunity for this misman-

agement, but positively invites it; or, to be even more exact, compels mismanagement. The city's advantage in obtaining money at a lower rate of interest is more apparent than real. The lower rate of interest is largely due to the wider margin of difference between the total bonded indebtedness and the property which secures this indebtedness, and as this margin of difference is trespassed upon, the interest rate goes up, not only on the bonds issued for the purchase of public utilities but also on all other city bonds. It does not require a very heavy advance in the interest rate on all of the city's bonds to wipe out all possible advantage on that score and to cause the city many thousands of dollars' loss, all to satisfy a craving to embark upon a business enterprise.

Austin, Tex., furnished an example of what may happen from an epidemic of the municipal ownership disease. When the bubble of promises made by irresponsible seducers of the public's judgment finally burst, the bondholders had to face the problem of accepting whatever compromise the city might offer or else suffer the repudiation of the bonds by the city. It is not out of place to call the attention of the practical American citizen to the fact that one city cannot revel in municipal ownership to the extent that it becomes necessary to repudiate its bonds without a slight discrediting effect on the bonds of all cities, and especially on the bonds of those cities which seem to have an itching to embark upon business undertakings. Eliminate this constant threat of municipal confiscation or competition and give the private company reasonable protection in its investment, and it will be able to secure funds on about equal terms with the city.

Does any reasonable human being believe there can be the same interest and loyalty on the part of the operators of a municipal undertaking that exist on the part of the operators of a private undertaking? No matter how sincere any one or more of the operators may be, the general average must of necessity be much lower.

The manager, engineer, and all other employees of municipal undertakings, must be: First, residents of that particular city; second, members or perhaps leaders of a certain political party; third, members in good standing of the dominant clique of that political party; and last, but not least, they are generally selected purely for their political ability, without any or with little regard for the qualifications they should possess for the positions they are to fill. Is it any wonder that the history of municipal ownership is a record of failures? Assume again that there is a $2,000 per year position to be filled with a municipally owned plant. Do you suppose for a minute that any man who can command the same salary with a private company would accept it and subject himself to the unmerciful criticism that is apt to follow political employment, with the prospect of finding himself out of employment at the next turn of the political wheel? As a rule, the man accepting political appointment as an engineer recognizes the lack of opportunity for advancement offered him in his profession, and he, therefore, is not inspired to the same excellent work as that which stimulates the man usually found employed by a private company. If ambitious for advancement, it is of a political character, different from that of his professional work, and he is not seeking proficiency in a professional capacity, but is probably seeking proficiency in the art of being a "good fellow," even though the attainment of his ambition in this direction be at the city's expense. The above, for the most part, refers to conditions under the "spoils system," and in view of former municipal ownership failures it is generally conceded, by even the most pronounced advocates of municipal ownership, that success under this plan is impossible. Some of them who are sincere actually feel that this has been the real and only cause of past failures, and all agree that this offers an excuse by which these failures may be explained. Civil service, they tell us, will change the history of municipal ownership from one of failure to one of success. For my own part, it is a question between the two systems. As a rule, a politician who cannot juggle civil service to secure the appointments he wants is unworthy of his calling. For certain classes of work, ability to pass a prescribed examination in geography, rhetoric, etc., is of no more significance than to have a certain prescribed length of the big toe. If a man has a bad breath, an ugly disposition, is lazy, or has a bad memory, the fact that he knows how far the earth is from the moon does not render him particularly more efficient. But the fact that he knows that his superior officer cannot remove him without good cause (which may mean for nothing less than stealing, fighting or getting drunk) is enough to render him an absolutely worthless employee. Civil service is a guarantee to the employee that he does not have to be any better than the prescribed minimum. He can be lazy, slightly insolent to his superior, instigate trouble, and discourage and disgust other employees, and the magnanimous cloak of civil service will shield and protect him. Civil service, as it generally exists, is one of the funniest jokes of the present century. I think the degree of failure of municipal ownership is apt to be just as pronounced under civil service as under the spoils system. Civil service and other such restrictions are the result of the knowledge, secured by experience, that unrestrained a public officer can be relied upon to misconduct his trust; but it probably has never occurred to many people that every restriction placed upon a public officer curtails his opportunity for good management more than it curtails his opportunity for corrupt practice. The very necessity for these restrictions is evidence of the impossibility of successful municipal management.

The ability of a city to operate a public utility plant at a profit at the rates charged by private plants is extremely doubtful. Or, stated in a slightly different way, it has not been proven that a municipally owned plant can furnish service any cheaper than can a private plant. Some examples are cited as evidence of the ability of municipal plants to furnish service at lower rates than private plants; but the reports furnished are not of a nature that would satisfy a close observer with an unprejudiced mind. Admitting for the sake of argument that the claims of the advocates of municipal ownership regarding these alleged successful plants are true, the fact still remains that for every success which they claim, at least two demonstrated failures can be cited.

Neither of these two reasons, therefore, meet our second condition, "Truth."

8. "To insure good service."

Probably none of the reasons cited are quite as much out of accord with our second condition, "Truth." No opportunity for good service is open to the city which is not available to a private plant, and few of the opportunities open to a private plant are available to the city plant. The inaccuracy of this claim is too easily demonstrated to demand any extended treatment at this time.

9. "To insure equitable division of profits from municipal utilities in the interests of all citizens."

This is another pretty dream, born only of sentiment, which needs but slight analysis to dissipate. The taxpayer is compelled to assume the risk of the success of the plant, and many of the citizens, and perhaps a majority of them, assume no responsibility for the risk. In many cities we have the absurd condition which permits a city to embark upon a business proposition if supported by a popular vote of the citizens. One can easily imagine a condition whereby a majority of non-taxpaying citizens would, against the wish of the taxpaying citizens, authorize the city officials to embark upon a business enterprise necessitating the creation of debt, for the satisfaction of which the property of the taxpaying and non-consenting citizens would be pledged. It is also easy to imagine a condition whereby a number of small taxpayers and large light consuming citizens would outvote nearly an equal number of large taxpaying citizens. This condition is inequitable and unjust, and to admit the fact that inequity to this degree is just, is sufficient warrant for the logical conclusion that direct confiscation of property is not unjust. To restrict this vote to the taxpayers only would offer greater equity; but all taxpayers are not voters, and while each voter is given an equal voice, the risk is not equally divided, but depends upon the tax division. Not matter what conditions prevail, justice does not warrant a majority in pledging the property of a non-consenting individual to a risk which will not benefit him, but which will in all probability harm him.

If the plant proved to be profitable, it is probably due to the fact that the light consumer is overcharged, and you then have the condition of the light consumers contributing unequally for the benefit of others.

Assume the plant is mismanaged and requires the collection of an excessive amount from the consumer. What means has he for redress? The laws of some States forbid the supply of service at less than cost, no matter how excessive this cost may prove to be. Misapprehension of the future good of the citizens has prompted some States to forbid, by statute, the granting of competing franchises for the supply of light, heat and fuel, and also to forbid the relinquishment of a municipal plant when once acquired. Prate about breaking up monopolies if you will, but under these conditions municipal ownership becomes the most pronounced, oppressive and odious monoply that could well be imagined; a monopoly placed in the hands of politicians, a class of people commonly designated by the press of the country as inconpetent and insincere. Here is a condition where the city must charge the full cost for service, no matter how excessive this may be, no franchise can be given to competing companies, and the city is forbidden to relinquish the plant, no matter how much loss may be occasioned. The whole question, when closely analyzed, is a grave reflection upon the study

and thought that the American public bestows on public questions, and this very condition, which the press so bitterly complains of, is conclusive evidence that the American people cannot and will not neglect their own private business in order to keep in touch with the conduct of public officers, and to inform themselves to a degree which will enable them to determine their willin gness and ability to intelligently and honestly conduct public affairs.

10. "To insure protection of employees of all public utility companies."

11. "To insure the city to have employment patronage that it can distribute amongst the needy."

12. "To prevent desirable positions from being given to men imported from other cities.

To argue against those reasons would almost be an insult to American intelligence. A passing comment, however, is not out of place.

Here are attempts to inject philanthropy and conditions contrary to economy into public service. Every reason given when properly analyzed is an argument against municipal ownersehip.

13. "To protect municipal officers from temptation."

14. "To purify politics, raise the standard of mnnicipal officers and secure honest administration of all public trusts."

15. "To compel citizens to take an interest in public affairs."

16. "To assist in raising the standard of living amongst the poorer classes by supplying them with public service at operating cost."

17. "To secure ownership by the people for the elevating effect on citizenship."

Crowded from the field of legitimate reason, the advocates have shown a talent for resourcefulness, ingenuity and sophistry worthy of a better cause. Has resourcefulness ever before been so dangerously strained, imagination more severely taxed, ingenuity more atrociously prostituted, or truth more brutally crucified?

Matthew, 25th chapter, 21st verse, in the 20th Century Bible, is made to read: "Thou hast been *unfaithful* over a few things, I will make you ruler over many things." The Bible of our fathers said: "Thou hast been *faithful* over a few things, I will make you ruler over many things."

Municipal ownership is to be made an institution of charity, and the needy are to be determined by their political faith. Citizens are to be compelled to neglect their own business to spy upon the conduct of municipal officers, or be robbed as punishment for their neglect of this unwillingly contracted public duty.

Municipal ownership is to raise the standard of living, and our mechanics shall become poets, painters and students of books on sociological subjects by authors whose arguments are created to bolster up previously expressed views born of prejudice and lack of knowledge. Sarcasm and satire are seldom effective weapons, but when logic is spurned, truth rejected, and reason assassinated, no other effective means of protest is offered.

To sum up, the reasons advocated for municipal ownership may be classed under 3 heads which, stated in the order of their importance, are: (1st), Economic; (2d), philanthropic; (3), sentimental.

The economic reasons are in general not well-founded, are scarcely ever in accord with truth, and are at great variance with experience. The advocates assume they can operate a public service plant with equal or greater economy than can private enterprise. This has not been proven true, or at least has not been proven true in the majority of cases where municipal ownership has been tried. Admitting for the sake of argument that the city could either make a profit in the operation of a public utility plant or could sell at a less cost if satisfied with no profit, the advocacy of municipal ownership of public utilities on this score is open to some objections and is not thoroughly in accord with wisdom. If economy is all that is to be sought, the city could enter into other business enterprises which, on the assumption that present operators' profits would either accrue to the city or be given to the consumer, would yield greater benefits to the consumer with less investment to the city and with less risk. Probably no other business involving the supply of commodities constantly required by the public yields such a small return on the investment as does the gas and electric business, and these commodities absorb less of the public expenditures. Two to $5 per annum per person for both public and private service will represent the total revenue of these two utilities combined. Why attempt to save a consumer $1 on light when the city might save him $4 on coal or $10 on groceries? We have already admitted that the city has one advantage over the private undertaking; viz., the securement of funds at a lower rate of interest. The average consumer pays from 10 to 20 times as much house rent as he pays for light. As the ownership of tenement houses resolves itself largely into a question of interest rates, the city could, by putting the same amount of money into tenement houses, save the citizens at least $10 to $20 for every dollar they could save them on light; and probably the saving would be greatly in excess of this, assuming that the city's operation would be just as economical as private operation.

If municipal ownership is to be urged for philanthropic reasons, almost any other form of businesss enterprise which the city might choose to embark upon would offer greater opportunity to benefit the citizens than does the operation of public utility plants.

From a sentimental standpoint, the arguments advanced in favor of municipal ownership are generally prompted by prejudice, which to a large extent is entirely unwarranted. It is useless to maintain that the present system of corporation operation cannot be improved upon, but it is utterly absurd to attempt to tear down the whole system because it has not attained perfection. The whole argument in favor of municipal ownership is so pronouncedly in discord with justice as to be repugnant to every fair-minded man after careful consideration.

There are bo dangers from corporation control which cannot be removed or restricted. If it is necessary to take control of public utility companies in order to protect municipal officers from temptation and to secure a higher standard of administration of public trusts, it is also necessary to assume control of the manufacture of baking powders, the manufacture of fire apparatus, the manufacture of paving material, and the manufacture of a thousand and one other commodities which have played an important role in the exposed corrupt practices in which public officers have indulged. To place corporations entirely and constantly in the hands of municipal officers leaves unlimited possibilities for corruption, but the dealings with corporations can be made of a periodic nature which must attract public attention and offer little or no opportunity for corruption. The making of burdensomé provisions for the control of public corporations is what forces many corporations into politics. When you subject the future of an industry, involving the investment of several hundreds of thousands of dollars, to the whim of politicians who can disfranchise the undertaking at will. or who can impose such restrictions on its operations as to jeopardize the investment, or who can fix rates at a time when an election may demand the supply of funds from an outside source, you are putting into the hands of these municipal officers, whom the press chooses to term the worst foes of the public, the means by which they can compel corporations to share a goodly portion of their profits. It is, therefore, only natural, and what might be expected from prudent business men, that those whose property is thus jeopardized should sometimes attempt to elect men to these offices who will not yield to the temptations to which inexperienced lawmakers have exposed them. While trying to protect themselves from coercion and blackmail, it is not to be wondered at that corporations should go a step further and attempt to fill these offices with men who will not only not menace the interests of the corporation but will protect them.

This difficulty is not an insoluble problem. In passing laws for the control of corporations, do not make the regulation of these corporations subject to the whim of municipal officers, but create some positive and fixed standard for their control. One factor which prevents absolute honesty in public office is the fact that no man is safe from assault in the fulfillment of his public duties, and this alone inspires dishonesty and deceit. The public distrusts municipal officers too much in general, and perhaps not enough in particular, and public opinion is seldom if ever correct in its measure of the interest or dishonesty of public officials. It is not my opinion that corruption is as general as the major portion of the public seems to believe; and I have had an excellent opportunity to study at close range many prominent politicians in different Western cities. I have seen some of these men shamefully abused by newspapers, for personal or other reasons, when conscientiously trying to do justice to their public trust. The great element of danger in the proper discharge of a public trust is the fact that no man, or at least very few men, are honest enough to do what they know is right in the face of contrary public opinion; and how can municipal ownership succeed when those in charge do not do, or do not even pretend to do, that which they know is right and for the people's interest? I was once adversely interested in a burden imposed upon a city which was such a gigantic fraud as to almost jeopardize the future of that city. A sensational press, not wholly disinterested, had stirred up to a remarkable degree public prejudice against a company with which I was connected. Some of the municipal officers were cognizant of the great injury being perpetrated on the city's future, and I appealed to one of them to exercise the perogative of his office in protecting the city against the ill-advised obligation it was about to assume. This man told me that he fully recognized the injustice being done to the interests of the city and

her citizens, but explained that, owing to public sentiment, he could not interfere. I asked him if he would allow the city's interests to be thus jeopardized while he remained silent, and his reply was that in the event he should do what he knew to be for the interests of the city, the public would believe that our company had bribed him to take this step. Here was a man whom I did not think could be bought or influenced to the slightest degree, and yet, rather than face personal censure or suspicion, he would allow the city's interests to be jeopardized to any extent whatever. The injustice of the recommendations of many municipal ownership advocates needs but to be pointed out to be appreciated by the public.

They hold that the municipal government has a right to condemn and purchase any public utility on the basis of the appraised valuation of the present worth of its physical property. This would often mean a purchase at a price much less than its cost to the present owners or original builders, and would always mean the direct confiscation of any value in excess of the original cost of the plant or its present physical valuation. As an instance of the injustice and inequity of this policy, I will cite an example which I used in a public address 5 years ago. We will assume a town of say 10,000 people. Two investors come to the town, whom for convenience I will designate A. and B. A. builds a street railway and B. invests in unimproved real estate. The town grows rapidly and prospers. A., by the nature of his investment, which is an operating property, must exert himself to secure its successful management, and incidentally, by building and operating a public utility, must contribute largely to the improvement and growth of the city, while B., owing to the nature of his investment, practically free from all responsibility or worry. He can live in Europe or any other place he may choose. In the course of 20 years the properties of both A. and B. have increased enormously in value owing principally to the growth of the city. At the end of this 20-year period the public steps in and demands from A. that he shall turn over his property at its then physical valuation, claiming that any equity in excess of this valuation belongs to the city. B. is not molested in the ownership of his property, and yet every dollar of increased valuation has been added without even contributory help from him. Who is more entitled to the so-called unearned increment of the respective properties, A. or B.? Does justice warrant confiscation of one man's property without molestation of the others? Do you think A. or anyone else would have put his money into a public utility company could he have foreseen that the successors of the public officers who solicited him to build his railroad for the benefit which would accrue to the city, would 20 years thereafter assert their assumed right to confiscate the increased valuation resulting from a 20-year investment and 20 years of hard work, incessant risk and constant worry? Every other investor in the town is allowed to reap this profit unmolested, and nothing less than the assassination of justice could deny this right to A. I have purposely put this example in personal form to momentarily bridge the prejudice from which a corporation must suffer when appealing for justice; but for convenience let us assume that A had not sufficient capital to undertake the building of this street railway, and he, therefore, associated himself with four other men of equally moderate means. Are these five men any less worthy of being entitled to justice simply because they individually possessed insufficient capital to undertake this enterprise alone? Would the injustice be any less because there were 5 men instead of 1 man; or would it in fact be any less if there were 50 men instead of 1 man. I think not, in spite of the general impression to the contrary.

It is only necessary to call attention to the fact that while there is generally a considerable value in these public utility companies in excess of their original cost, there is not a single city where there has not been some real estate which has had an appreciation in value very much in excess of the appreciation in value of any of these public utility plants. I think you will also agree with me that if A.'s equity is to be confiscated, B.'s equity should also be confiscated. But who has a better right to the equity than A. and B.? If this equity is to be confiscated in the interest of the public, the benefits should be equitably apportioned. Is it to go entirely to the taxpayer or entirely to the light user?

If other examples are demanded of the injustice of the position of municipal ownership advocates, I might cite the conditions which actually exist in a certain Western city. A certain body of public-spirited men got together in the early days of the art and organized an electric lighting company and built an electric lighting plant. Later this same body of men organized another company and built a refrigerating plant, circulating the refrigerating medium through the streets in much the same way that gas is distributed. The electric lighting plant, after many years of trials and tribulations, has become a pronounced success. The refrigerating plant was a dismal failure and much money was lost. There has now developed a determination on the part of some of the citizens to confiscate the electric lighting plant at its physical valuation. The owners are to be shorn of their profit in the electric undertaking, but are, of course, allowed to pocket their loss on the refrigerating plant. If the city is going to demand the profit on one, the least it can do is to bear the loss on the other. Is it fair to confiscate the profit in the electric light plant when, should it have proven a failure, these owners would have been compelled to have borne the loss? Surely the commonest kind of manly fairness must prompt a negative answer.

Let us take another example which actually exists. A gas plant was built in the early days by a few enterprising men in a small Western city. Later some of the same men also built a district steam heating plant. The city has since had a wonderful growth, and the gas plant has become a valuable piece of property. The steam heating plant has proven a losing venture. The city has already taken the preliminary steps to condemn and purchase the gas property. Those engineering the scheme propose to confiscate the so-called unearned increment of the gas property and leave these same men to bear the loss on the steam heating plant alone.

While it is not probable, it is still perhaps possible to secure the direct conversion of heat energy into electrical energy on a commercial scale. Given such a condition, it would render the major portion of our present properties worthless. It is very easy to imagine a condition whereby the public would be planning to condemn and purchase our property at its physical valuation and by right of might would compel our acceptance. While these condemnation proceedings are pending, the solution of how to transform heat energy to electrical energy is discovered and the valuation of our property shrinks accordingly. In this event it is certain that the public would step down and out and would courteously allow the present owners to bear their loss alone. This is a kind of a "Heads I win, tails you lose" proposition.

Municipal ownership cannot be brought about on the present plans of the advocates without doing grave injustice to the present owners of these properties. This is one of the reasons why I have said that this question demands fearless and determined treatment. I have absolute faith that the American people as a body will not willingly make themselves a party to any unjust act. My more apparent and better reason for recommending fearless and determined treatment is to enable us to appeal to the judgment of the public by demonstrating to them that the claims of the advocates are unwarranted by experience already gained, and that municipal ownership means to the city poorer and more expensive service, with no profit in operation, and probably a heavy loss. The National Electric Light Association have given this subject much thought and study, and they are convinced that a thorough investigation of the municipally owned plants will demonstrate that the majority of them now in operation are rank failures, and that 90 per cent. of all municipally owned plants (including the confessed failures which have already been abandoned) will be demonstrated to be or to have been failures. Would any practical man recommend embarking on a policy which has already been proven to be such a fallacy? The National Electric Light Association have demonstrated their faith in this proposition by offering to join the League of American Municipalities in an impartial investigation of the results secured in municipal plants, and as an evidence of good faith the former body tendered the latter body a certified check in the sum of $2,500 to cover their portion of the expenses of this investigation. They also stand ready to make this same proposition to any other body or to any individual or individuals who claim to have faith in the success of municipal ownership.

Municipal ownership, should it become general, would, owing to lack of personal interest, legal restrictions of management and unwarranted criticisms of managing officers, cast a blight on the progress of the lighting business, and instead of leading the world in this art America would lose supremacy.

The more experienced advocates of municipal ownership know that to bear out their claims, they are unsafe in citing American examples and they must seek examples in foreign countries. While not admitting that municipal ownership is a success abroad, it is irritating and humiliating to find a class of American residents who prefer a foreign system to an American system, and who want us to adopt the policy of these decaying nations, even though this very policy may have caused the decay.

Advocacy of municipal ownership is largely prompted by dislike for all corporations, which has been greatly increased by the fancied danger to the people's interest arising from these recent and larger corporations commonly designated as trusts. These people forget that fixed natural economic laws demand operation on a huge scale and that American supremacy in the markets of the world is only possible by our present system. These so-called Americans who wish to tear down our present system may console themselves with the fact that foreigners should, and probably do, appreciate their efforts. The operation of our present system may not permit distribution of benefits to a fine-haired degree of accuracy, but there can be no doubt that all classes and all individuals receive some benefits.

Methods which have made America rich and powerful are good enough for me. Those who wish may take their example from those nations which are traveling toward the dark. This country is already in the lead and is still climbing, and should it ever cross the divide and start downward, I thank God I will not then be alive to see it. The fact that a few men, by merit or chance, get a bigger piece of pie than I do, will never prompt me to cry out against the institutions and methods which have enabled this nation to get a bigger piece of pie than other nations.

Notes on the Operation of Large Carburetted Water Gas Sets.

[A paper read at the Thirty-first Meeting of the American Gas Light Association (Detroit, Mich., Oct. 21st, 22d, 23d), by MR. W. CULLEN MORRIS, Long Island city, N. Y.]

In the last 2 or 3 years there have appeared in the *Journal of Gas Lighting* several papers on the theory of water gas processes, extensive in their consideration of factors affecting the composition of the resulting gas. In nearly all these papers the effect of an excess of steam is discussed at some length, and without a more definite conclusion than that there is a proper rate of flow, possibly different for each type of apparatus, and that this rate is affected by the temperature of the fire. Dr. J. Kramers, in his paper on "Water Gas Manufacture in Theory and Practice," after a rather lengthy consideration of the effect of an excess of steam, concludes, that:

"1. An endeavor must be made to obtain the highest possible temperature in the generator.

"2. One must try to have as little as possible undecomposed steam in the gas, not only because it carries off many calories, but because it may cause the proportion of carbonic acid to rise considerably, and the heat thereby liberated is of no advantage to the generator."

Drs. H. Stracke and R. Jahoda, in their discussion of the "Theory of the Water Gas Process," lay particular stress upon the rate of flow of the steam, and imply that Dr. Bunte, in his work, did not appreciate the effect that different rates of flow would have upon the resulting gas. In the course of their paper they write:

"1. That, at a particular temperature, both the steam passing through undecomposed and the proportion of carbonic acid in the gas largely increase with the increase in the rate of the steam, and, moreover, increase to a similar extent.

"2. That with a constant rate of flow of the steam, both the steam and the carbonic acid in the crude gas decrease with increase in the temperature.

"3. That at low temperatures the carbonic acid and steam in the crude gas can be reduced to a minimum by diminishing the rate of flow of the steam."

And in their summary they give the following table:

Rate of Flow of Steam.	Minute of Run at which Observation was made.	Temperature of Generator, Deg. C.	Temperature of Effluent Gas, Deg. C.	Undecomposed Steam—Percentage of Total.	Carbonic Acid Per Cent.	Efficiency of Run. Per Cent. of Maximum.	Total Efficiency. Per Cent. of Maximum.
0.58	2	790	228	1.3	7.1	.....	....
	5	788	207	2.7	4.6	69.0	54.5
	12	785	214	9.1	6.2	67.0	53.0
	20	778	221	21.8	8.9	60.5	47.0
	35	740	200	48.8	13.0	42.0	33.0
4.40	1	860	390	4.0	2.2	92.0	75.0
	3	850	390	10.0	2.7	91.0	74.0
	6	816	365	22.0	4.5	90.0	75.0
	9	810	365	24.0	6.6	88.0	73.5
	12	796	408	28.0	8.7	86.3	71.8
	16	775	415	45.5	11.4	83.5	71.0
7.50	1	....	530	....	2.7	....	....
	3	....	515	11.7	4.6	90.0	69.0
	6	....	490	27.4	9.6	88.0	70.5
	9	....	470	54.2	12.6	78.0	63.0
	12	....	470	62.1	15.6	73.0	59.0
8.10	1	....	515	....	3.4	....	....
	3	....	510	1 3	5.5	91.0	71.0
	6	....	500	19.7	11.2	88.0	70.0
	9	....	475	....	14.9	86.0	71.0
	12	....	470	47.9	17.3	82.0	68.0
13.00	1	....	470	7.6	3.4	92.0	73.5
	5	....	500	11.9	5.6	91.5	73.0
	6	....	500	32.1	9.0	92.0	71.5
13.40	1	900	470	14.3	5.0	91.5	72.5
	3	880	478	27.9	6.9	89.0	71.0
	6	830	475	48.9	9.4	84.0	67.5
	9	800	493	62.8	13.1	77.0	62.5
	12	780	492	69.6	13.9	74.0	60.0
17.00	1	....	600	8.1	2.6	91.0	69.0
	3	....	590	25.8	5.3	88.0	67.0
	6	....	560	48.5	11.8	81.0	62.0
	10	....	540	73.6	14.9	67.5	51.0
	12	....	530	76.5	15.2	65.0	51.0
21.20	1	945	680	8.6	4.4	90.5	70.5
	3	910	650	41.3	6.8	83.0	63.0
	6	865	620	48.6	8.7	81.0	61.5
	12	805	590	70.1	14.4	68.5	53.5
	16	780	....	77.6	17.6	61.5	47.0
21.30	1	....	680	....	2.1	....	....
	3	....	650	23.0	6.0	90.0	70.5
	6	....	620	63.3	11.8	72.5	54.0
	10	....	595	77.1	14.8	61.5	46.0

The researches of Harris, under the direction of Dr. Bunte, were tabulated as follows:

Temperature. C°	Composition of Gas Volumes, Per Cent. H	CO	CO_2	Water Vapor, Per Cent. Decomposed.	Undecomposed.
694	65.2	4.9	29.8	8.8	91.2
758	65.2	7.8	27.0	25.3	74.7
838	62.4	13.1	24.5	34.7	65.3
838	61.9	15.1	22.9	41.0	59.0
861	59.9	18.1	21.9	48.2	51.8
954	53.3	39.3	6.8	70.2	27.2
1,010	48.8	49.7	1.5	94.0	6.0
1,060	50.7	48.0	1.3	93.0	7.0
1,127	50.9	48.5	0.6	99.4	0.6

If we take the table of Drs. Stracke and Jahoda and retabulate for percentages of carbonic acid in the neighborhood of 6 per cent., we obtain a table as follows:

Rate of Flow of Steam.	Minute of Run at which observation was made.	Temperature of Generators.	Undecomposed Steam. Per Cent. of Total.	Carbonic Acid Per Cent.
0.58	12	785	9.1	6.2
4.40	9	810	24.0	6.6
7.50	3	....	11.7	4.6
8.10	3	510	1,3	5.5
13.00	3	500	11.9	5.6
13.40	3	880	27.9	6.9
17.00	3	590	25.8	5.3
21.20	3	650	41.3	6 8
21.30	3	650	23.0	6.0

Considering this tabulation, we see that, with two exceptions, at the third minute of the run the carbonic acid is never in excess of 6.9 per cent., no matter what the excess of undecomposed steam may be. Also, there does not appear to be any special relation between the temperature and the amount of carbonic acid, nor does the rate of flow of the steam bear any definite relation to the amount of undecomposed steam, or more particularly the amount of carbonic acid. This certainly appears strange, for surely the temperature of the fire must have some effect upon the quantity of steam decomposed. That the rate should not have any great influence does not surprise me, as I do not see that, other than requiring an additional amount of heat to be supplied, why, up to a certain point, it should have any appreciable effect. If we consider Harris' results for 6 per cent. of carbonic acid, and compare it with an average of the above, we have:

Temperature, C°.	Undecomposed Steam, Per Cent.	Carbonic Acid, Per Cent.	
954	27.2	6.80	Harris.
672	19.6	6.06	Stracke and Jahoda.

A comparison that does not show any great agreement. Of course, the methods of obtaining these were different, as different as laboratory work is from that of the manufactory; but still one would expect a closer agreement than this.

The frequent extensions of the plant at which I am stationed have prevented the devotion of much time to precise observation, but in the operation of our apparatus, daily records are made covering the grosser factors influencing the running of the carburetted water gas sets. Recently there were installed at this works 8 carburetted water gas generators of the double-superheater type having an internal diameter of 9 feet. The new sets differed in their principal dimensions from the 11-foot sets that had been previously installed, as shown below:

		11-Foot Sets.	12-Foot Sets.
Generators	O.D.....	11 feet.	12 feet 0 inch.
	I.D.....	8 "	9 " 0 "
	Depth.....	7 "	7 " 0 "
Carburetters	O.D.....	11 "	12 " 0 "
	I.D.....	8 "	9 " 0 "
	Height.....	16 "	18 " 8 "
Superheaters	O.D.....	11 "	12 " 0 "
	I.D.....	8 "	9 " 0 "
	Height.....	22 "	24 " 3 "

Naturally we were interested to learn if our anticipation in regard to these large sets would be realized. We had good reason to believe that they would equal in make and economy the 11-foot sets, and it was with a great deal of impatience that we waited for the summer falling off in demand to occur, so that we might operate the new sets by themselves and determine their capabilities.

The data was accumulated with the idea of determining the proper rate of flow of steam supply to the generators for producing the best working results. It is not always possible to maintain laboratory perfection in operating a large number of units, and when determining the conditions governing the working of apparatus it is always well to experiment under the conditions that will exist in their everyday use. The results that we will later consider were obtained under such conditions as would exist in everyday practice, and no pretension is made that they are the best that could be obtained for this type of apparatus.

No special precautions were taken to produce gilt-edge results; each recorded test was continued until the results were characteristic of the particular conditions, and would, I believe, be reproduced upon the return to these conditions.

In starting a particular set of conditions instructions were given to the head gas maker to alter so-and-so, in exactly the same manner as is frequently necessitated by a change in the character of the fuel, oil or other element entering into the process. As a consequence, it is not possible to state that the conditions were always precisely maintained. All the results set forth were compiled from the daily reports, and, consequently, do not include any unusual or special observations such as might have been made had it entered the writer's mind that he should at some later date desire to incorporate them into a paper for this Asso ciation.

In making these rough tests there was another object besides that mentioned: A desire to demonstrate to our full satisfaction that we had not lost in economy or productive capacity by increasing the grate area over the 11-foot sets. Previous experience with one of the old 11-foot sets, in which we had enlarged the grate area and internal diameter by thinning the lining, had led us to expect at least as much from the new sets, both in fuel per 1,000 cubic feet, and in make per square foot of grate area.

Before entering into a consideration of the results it would probably be well to briefly describe the method of operating the sets throughout the series of tests, so that a full understanding of the tabulated data may be obtained. Each machine consists af the regular type of United Gas Improvement Company's double-superheater set, consisting of a generator, carburetter and superheater. The apparatus is provided with a mechanism for reversing the direction of the flow of gas from the generator, and to this mechanism we have attached a device for effecting, at the same time that the gas flow is reversed, a reversal in direction of flow of the steam. Before the steam enters this device it must pass first through a globe valve opened by the gas maker, and then through a plug cock set at a desired opening. This cock is provided with a pointer on the plug and a scale on the body, the position of the pointer showing on the scale the degrees that the cock is open. Between the valve and the cock there is attached a steam gauge, showing the pressure of the steam before entering the cock. By this device the quantity of steam supplied per minute can be determined, as the cock has been calibrated for several inlet pressures and openings.

The direction of the flow of the steam through the fire bed is reversed in each run, a part of each run being made with the steam first passing down through the fire and then finishing with the steam passing up through the fire bed. The blows are so regulated as to produce a proper heat in the fire and to raise the checkerbrick to a temperature sufficient for fixing the oil. The fires are cleaned at the end of 12 hours, and only the ash is removed. The refuse from the fire is screened and the small quantity of half-burned coal returned to the generators.

In comparing the old and new sets I have taken the best results obtained on the old sets with the same kind of fuel; but in considering this it must be borne in mind that the results were obtained in a different year, and the coal might not have been of the same character, possibly being mined from a different seam. I speak of this because the steam was in this test supplied under a different set of conditions from the best result obtained on the new sets. In all cases the actual oil results have been omitted, as they would only apply to the particular season of the year in which the tests were made. Table No. 1 contains the data governing the conditions and the results obtained for each of the several methods of running.

In comparing the tests it is assumed: That a yield of 5.8 candles per gallon is a fair yearly average, with gas oil, for finished gas containing 3 per cent. of carbonic acid: that 1 per cent. of carbonic acid will depreciate the candle power ¼ of 1 candle, or that each increase or decrease of 1 per cent. in the quantity of carbonic acid present, over or below 3 per cent., would affect the oil required to the extent of 3 per cent., or would affect the cost of gas per 1,000 cubic feet to the extent of $\frac{5}{10}$ths of 1 cent (the cost of oil is taken at what would seem a fair average price) the desired candle power being 25 candles. The amount of oil required is not entirely governed by the quantity of carbonic acid present. Uniform and proper heats are necessary, and a condition that will produce this state is the most desirable. Further, that the cost of 1 pound of steam supplied to the generators would be 0.0275 cent, made up of the following items:

Per pound of steam supplied—	
Boiler room labor	0.0070 cent.
Water	0.0016 "
Coal	0.0182 "
Steam to feed pump	0.0007 "
Total cost	0.0275 "

That the cost of air required by the generators may be considered constant per 1,000 cubic feet of gas made, and, therefore, need not be taken into account.

That the cost of generator fuel is $5 per gross ton, and that the cost of the generator house labor required and affected in the considerations is as follows:

No. of Sets Running at One Time.	Five.	Six.	Seven.
Gas makers	10—$27.00	12—$32.40	13—$35.10
Stokers	6— 12.00	6— 12.00	6— 12.00
Coal men	4— 8.00	4— 8.00	4— 8.00
Ash men	4— 8.00	4— 8.00	4— 8.00
Per 24 hours	24—$55.00	26—$60.40	27—$63.10

Further, that 13 million cubic feet is the desired daily make.

Considering this last assumption, it will be seen that to accomplish this make it will be necessary to consider each case separately and determine the number of generators necessary for producing this make. Small repairs of various kinds, such as new oil sprays, etc., are re-

TABLE NO. 1.—*Results on 12-Foot Carburetted Water Gas Set.*

Case number	A	B	C	D	E	F	11-Foot Sets. G
Velocity of steam, pounds per minute	67	77	87	97	102	107	72
Steam cock opening, degrees	75	75	75	75	75	75	67½
Steam pressure, pounds	50	60	70	80	85	90	70
Length of blow, minutes	6.5	6.5	7	7	7	7.5	7
Length of run, minutes	8	8	8	8	8	8	8
Minutes up	3	4	4	4	4	4	4
Minutes down	5	4	4	4	4	4	4
Blast pressure. inches	18	18	18	18	18	18	20
Per 1,000 cubic feet. Generator coal, pounds	33.12	36 14	33.28	33 19	32.73	34.22	33 3
Per 1,000 cubic feet. " cinders, pounds	1.06	1.83	.82	.93	.75	.77	0.0
Per 1,000 cubic feet. Steam, pounds	19.84	24.19	24.87	26.65	27.94	30.31	24.03
Per square foot grate per hour. Generator coal, pounds	49.88	50.41	50.98	53.77	51.81	52.81	53.42
Per square foot grate per hour. " fuel, pounds	51.48	52.97	52.24	55.28	53 00	54.01	53.42
Per square foot grate per hour. Steam, pounds	29.88	33.75	38.10	43.17	44.23	46.65	38.63
Per square foot grate per hour. Make, cubic feet	1,506	1,395	1,532	1,620	1,583	1,539	1,608
Time between cleans, hours	12	12	12	12	12	12	12
Average time spent on cleans, minutes	72	104	75	69	62	62	69
Carbonic acid, per cent	2.8	3	2.9	3.1	3.2	3.1	3.1
Length of test, days	7	3	5	10	10	3	5
Final condition of fires	Bad	Bad	Bad	Good	Good	Fair	Good
Remarks	Time required to clean fires increased from 65 to 90 minutes, due to increasing clinkers.	Coal very dirty and small from much handling; thus reducing the make.	Make generally fell off, due to increasing clinkers and increasing time required to clean fires.	Condition generally easy to control.	Fire soft. Otherwise conditions good.	Condition generally good. Fires tend to become too soft causing loss of coal when cleaning.	Fires some what hard.

quired during the day, causing a small loss in the available running time of each machine. On these repairs the gas makers can be employed to advantage, so that any delay not exceeding, say, in our case, 6 hours of the total running time, would not affect the cost per 1,000 directly chargeable to gas making.

When the number of hours required is not over 12 hours, that required for an even number of generators, it will be assumed that an extra generator can be run during the cleaning periods; thus, not requiring an additional gas maker, as the time taken on cleans with 6 generators will amount to at least 12 hours.

Examining each case with a view of running the least number of sets, and utilizing the gasmakers' time to the best advantage, we find that the desired amount (13 million cubic feet) could be manufactured as follows:

Case.	Number of Hours Running.	Number of Hours Idle.	Number of Gas-makers Required.—Day.	Night.	Number of Sets Under Fire.	Remarks.
A	135.9	8.1	6	5	6	See Note 1.
B	134.7	9.3	6	5	6	See Notes 1 and 2.
C	133.5	10.5	6	5	6	
D	126.3	17.7	5	5	5	
E	129.1	14.9	5	5	5	
F	132.8	11.2	6	5	6	
G	160.7	7.3	7	7	7	

Note 1.—It is very probable in this and the next case that the fires would become so hard, possibly all at one time, that it would be necessary to hold extra sets under fire. This point has not been taken account of in the discussion.

Note 2.—It is hardly fair to consider this case as set forth in the test. The conditions producing the results were unusual, the coal that was used having been much handled and very dirty. In our consideration it has been assumed that for this case the results would be a mean between cases A and B, and that the carbonic acid would be the same as for case B, if all other conditions had been equal. If we now tabulate from the foregoing data the costs for each case, we will obtain a set of figures from which we can with limitations determine which is the most economical. This has been done in Table No. 2.

TABLE NO. II.—*Cost per* 1,000 *Cubic Feet.*

	12-Foot Sets.						11-Foot Sets.
	A.	B*.	C.	D.	E.	F.	G.
Generator house labor	0.44385	0.44385	0.44385	0.42308	0.42308	0.44385	0.48538
Cost of steam	0.54560	0.61476	0.68393	0.72288	0.76835	0.83353	0.66083
Additional cost of oil	0.10000	0.05000	0.05000	0.05000	0.10000	0.05000	0.05000
Generator fuel	7.39238	7.41024	7.42810	7.40801	7.30534	7.63790	7.43256
Total	8.28183	8.41885	8.50588	8.60397	8.59677	8.96528	8.62877

* Assumed results.

Other factors should enter into our consideration of these figures. I have before referred to the fact that other influences affect the quantity of oil required. I have frequently noticed that, when changing from a lower to a higher rate of steam, the amount of oil required was appreciably decreased. I can only explain this in one way. That the cracking is accomplished to better advantage if some steam is present, probably by prevention of over cracking.

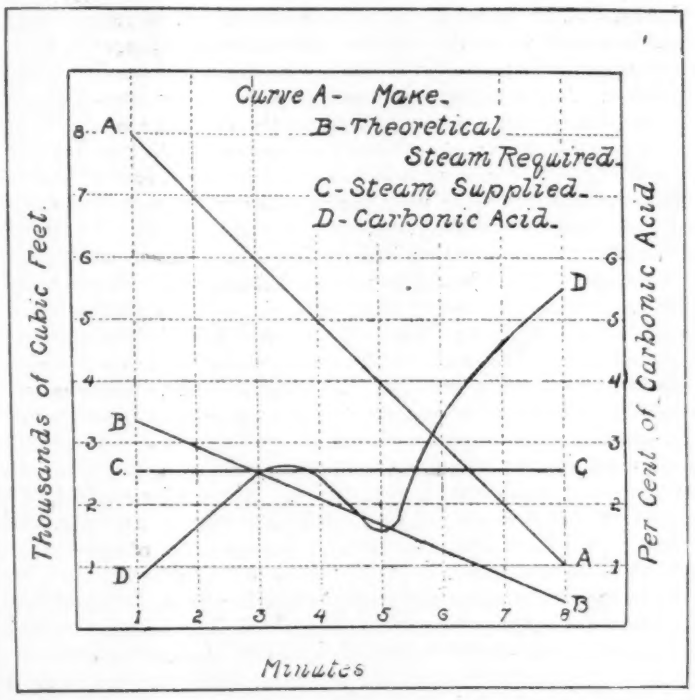
Then, again, cases A, B and C are difficult to maintain for a long period, and it was not easy to keep the heats in the fixing chambers uniform for these cases. The advantage of a system of running which will produce the same results day after day is of paramount importance and cannot be stated in dollars and cents, and would not appear in our comparison of costs. In comparing the economy of the 12-foot and 11-foot sets, the difference is in favor of the larger sets. The make per square foot of grate is virtually the same.

Considering the original outlay of capital: Case A, if possible, to maintain, would require at least 7 sets; case E, 6 sets, and case G, 8 sets. If we assume wear and tear to be covered by 15 per cent. of the original cost, we would have charges per 1,000 cubic feet as follows:

	Case A.	Case E.	Case G.
Previous cost	8.282	8.597	8.629
Wear and tear	0.420	0.360	0.401
New total	8.702	8.957	9.030

Still showing to the advantage of the larger sets.

Case A is considerably lower than case E; but I am free to confess that I believe—in fact, my experience has shown—that there is not the difference in oil results indicated by the figures, other factors, uniform heats, etc., affecting the results to a greater degree. Still it is more than probable by changing some other factor, blast, time of cleaning fires, or depth of fire bed, that this low steam result could be maintained successfully.



Returning to a consideration of the effect of the rate of flow of the steam upon the amount of carbonic acid formed, the results obtained on this type of apparatus do not agree with the claims of the writers before referred to. In our case the mean percentage of carbonic acid is about 3, or about 5 per cent. in the blue gas. The amounts of steam supplied vary from 24 to 90 per cent. excess, with no considerable variation in the amount of carbonic acid formed,[1] and, as stated in the early part of this paper, I consider that the temperature of the fire bed is a greater factor than the rate of flow of the steam, within reasonable limits.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, Oct. 10th., 1903.

Gas Works in Scotland.—Save the Ashes.—Some Large Gas Engines.—The Erratic Arc.

Those who believe in municipal ownership of gas undertakings might do worse than turn an attentive eye to the progress of affairs at several towns in Scotland, where the concern is the property of the local authorities. I cheerfully admit there are examples, such as Edinburgh and Glasgow, of successful corporation management in that country. And the explanation is that the Gas Committee have the good sense to select competent heads, both in the technical and commercial departments, and having selected them to treat them properly, and to respect their advice. The engineers and managers are allowed to exercise the needful degree of authority, and are left untrammelled by personal, political or other outside considerations, with the result that they are able to make a good showing both for the owners of the undertaking and for the consumers of gas. But I could quote other instances where this proper and indeed necessary state of affairs is not maintained, and the so-called "manager" is hampered and harassed in a way that is certainly not conducive to bringing out his best abilities. He would be superhuman if he pleased everybody. There are times when the interests of his employers necessitate a prior and uncompromising attitude towards certain individuals, who may be workmen, or consumers of gas. The workman is apt to consider that he either does too much, or gets too little, and as regards the consumer we may merely substitute one word "pays" for "does," and in either case—fortunately the exception and not the rule—an individual is occasionally met with who is not amenable to reason, and because he cannot get all he wants, conceives a violent personal grudge against the manager. Now it really seems that in some of the smaller towns, such a person will have no difficulty in finding a town councillor who for one reason or another will be prepared to father his grievance, and to bring it before

1. Curves showing make, steam required, steam supplied, and carbonic acid, for each minute of a run. The steam required was determined from an analysis of the finished gas

the Council, where it is discussed without the manager being able to make a direct reply. Another stumbling block in municipal ownership is the proper handling of a rapidly increasing business. A growing business necessarily calls for further outlay. And the manager of the Corporation gas works is often terribly harassed by delays, legal and otherwise, in respect to the funds for extensions. One or two cases might be named where the treatment meted to the manager has given rise to unenviable notoriety, and this sort of thing cannot be helpful to success. A considerable proportion of the happy family element must be present on the managing committee in order to secure the best results, and this is not impossible in the municipality, but far less likely to obtain than with a private company. The latter, to say the least, have a common interest in maintaining order and good will that is absent from the local authority. The director of a company has not inducement to strike out on an independent path away from the rest of his colleagues. If he does not approve their policy he simply resigns his seat. But the manager of the municipal gas works frequently finds two or more contending parties on the board and that it is impossible to please both, and he is bandied about from pillar to post, as one or other happens to gain the ascendancy for the time being. There may be political and other issues concerned in the question of municipal ownership, but looked at from the strictly utilitarian point of selling at the lowest remunerative rate, the executive management require the support of a competent directing committee. Municipal ownership will not prevent this nor will the joint stock proprietorary secure it. But companies are more likely to get and to keep a competent working board than municipalities.

The question of utilizing spent mantle dust has more than once been raised, and has again attracted attention through a statement made by Mr. Julius Norden of the United Chemical Works, to the effect that his Company can afford to pay a minimum of 10s. per pound for fairly clear remnants of incandescent mantles. He suggests that if the lamp attendants were supplied with bags for the purpose, it would not be a difficult matter to collect 10 to 50 pounds of mantle dust in a twelvemonth. There is certainly something in the suggestion, in view of the rumored corner in thorium, but regarded as a new source of profit for gas undertakings, there is less in it than in the collection of other refuse. The ashes of mantles are extremely light and at a moderate estimate the remains of about a 1,000 would be required to make up a pound. A company using 2,000 mantles per annum would collect £10 worth of residue, but this £10 would not be clear profit. The time lost in the collection of the mantle light fragments would be a very appreciable quantity. Considerable care would be necessary in the case of public and other outside lamps, to insure the safe transfer of the gossamer-like scraps into the proper receptacle. The gross profit on the transaction would be barely $\frac{1}{10}$d. per mantle, and the figure of 10s. per pound will have to be cousiderably increased before it will be worth while for large users of incandescent mantles to incur the trouble and expense involved in saving the ashes. It is interesting to know that the United Chemical Works have already dealt with considerable quantities of ash, and find that the thoria recovered from the same is in every respect equal to that obtained direct from monazite sand. Mr. Norden puts the annual consumption of mantles in England at 50 millions, and the waste product at 110,000 pounds, from which it would appear that £50,000 worth of thorium is scattered to the winds annually in this country alone. He estimates the annual production of Germany at 150 millions, of the United States 100 millions, and of other European countries at another 100 millions, and that Germany and Austria between them supply the European market with thoria and ceria. The reason he gives for mantles being made cheaper in Germany than in England are that alcohol and female labor are cheaper in the "Fatherland" than here. The big figures quoted are an interesting illustration of the extent to which incandescent gas lighting is used, and further of the extent to which gas is used, for each mantle means a consumption of at least 500 cubic feet of gas.

An installation of gas engines has been put down at Chelsea, London, in connection with the new pumping station provided for the purpose of relieving the low level sewers in time of storm. The total cost was £16,000, of which about one-fourth represents that of the engines and pumps. There are 8 centrifugal pumps, each having its own independent engine. Four of the engines are each 210 I. H. P. capacity, equal to lifting 41 tons of water per minute to a height of 28 feet, while each of the other 4 are 260 I. H. P., capable of lifting 83 tons of water per minute to a height of 14½ feet. The main gas supply pipe is 15 inches diameter and there is a 500-light meter for each engine. The consumption of gas per horse power hour is calculated to be 18 cubic feet, and this will lift over 16 tons of water to the average height of 21 feet. When working at full power the consumption of gas will be 550 cubic feet per minute and the cost per hour just over £5, while 500 tons of water will be lifted per minute. The particular advantage of the ordinary coal gas supply lays in its being available at a minute's notice at any time day or night, Sunday or holiday. Storms are apt to come with but scant notice, and do not allow time to get up steam or to warm up the generator in a water gas set. The cost for running is remarkably low, having regard to the work to be done, and figures out to less than ½d. per ton of water lifted, and the whole is a striking example of the applicability of coal gas to intermittent work on the large scale.

The electric arc light still maintains its peculiar characteristics, which are apparently inseparable from that type of apparatus. At a meeting of the District Council at Redruth, Cornwall (a place well known as the residence for many years of Wm. Murdock, the inventor of the coal gas industry), a member directed attention to the defective quality of the light, complaining that at times the light dwindled and sometimes went out altogether for a second or two, and this occurred to such an extent as to constitute a grave public danger. The newspapers are very sarcastic about the lighting of the Drill Hall at Sheffield on the occasion of an important political gathering. In the words of angry reporters, "The quivering arc lights lit up the unlovely interior with an uncertain glamor. Huge arc lights gave doubtful illumination to the hall, and the spluttering of the lamps must have been as disconcerting to the speaker as it was to the large army of reporters ranged below him." Fortunately incandescent gas lights were available, and these were brought to the assistance of the erratic arc, amid ironical cheers from the audience. At a meeting of the Perth Town Council, Councillor Mitchell proposed that the present electric lighting be discontinued and the whole of the streets lit with incandescent gas lamps. He contended that the electric light was a failure for street lighting, and that the adoption of his proposal not only meant a saving of £800 per annum but would secure much better lighting. The present cost is about £3,000, so the saving is a matter of over 25 per cent. Yet with all this manufacturers are to be met with who adopt the term "arc" to high power gas lights. It is better to leave the sudden, jumping, flickering and chameleon light effects that are associated with the term "arc" to die a natural death, and to select some more distinctive term that will give a better idea of the steady, pure, even-colored light that can be obtained from any efficient combination of incandescent gas burners. It is difficult to fix the actual illuminating value of a varying light. Obviously it is not fair to take the maximum effect produced, perhaps only for five minutes out of every hour. A gas light remains constant, and an accurate reading taken at any minute represents the lighting value given for hours or even days. But with the electric arc it is a question of whether the operator happens to catch a greater or less proportion of the scintillating rays that are scattered forth, first in one direction and then in another, the path of each being a very small spherical angle.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. C. O. G. Miller, formerly President of the Pacific Lighting Company, of San Francisco, Cal., has been elected a Director in the San Francisco Gas and Electric Company, and is also a member of its Executive Committee. The San Francisco Company now owns all the properties of the Pacific Lighting Company, through merger agreements.

The Board of Trustees of Downers' Grove Village, Ills., has authorized the La Grange Gas Company to lay pipes for the supply of gas in the Downers' district. Col. Ira C. Copley, of the La Grange Company, seems to have been rather liberal in his proposition to the Downers', since he agrees to furnish the municipality with 1,200,000 cubic feet of gas free for public purposes, and to supply gas to ordinary consumers at the rate of $1.25 per 1,000 cubic feet. He also agreed to have four miles of mains put under the highways of Downers by October 1, 1904. Good for the clever Yale man; and no one better than the same gentleman knows that liberality is the best card that ever was played.

A correspondent in Cincinnati, O., forwards the following under date of the 26th ult.: "The examination of the accounts of the electric lighting plant owned and operated by the City of Ashtabula, O., made by agents of the State Auditor has been completed. It shows that for the past 10 years the city lights have cost, on the average, about $100 per year each, and that cost is based on what is known as the moon-table schedule, which should represent a schedule on the all night plan as 75 is to 100. The original cost of the Ashtabula plant was $63,500.64 up to 1893, and from that year, until August, 1898, $24,751.15 additional

was expended for extensions and betterments. This brought the total construction cost up to $88,251.79. In 1898 a committee was appointed to fix the actual value of the plant, which was placed at $55,666.12, showing a depreciation below actual cost of $32,586.67, or over 7 per cent. per year. The annual operating expense is $60 per light per year, which sum is paid by general taxation upon the taxable property of the city. No allowance is made for depreciation in this connection, because the extensions and betterments made to the plant out of the revenues, without direct taxation on city property, approximate 7 per cent. per annum and practically provide for the depreciation as shown by the appraisement. The sum of $19,525.36 has already been paid for interest charges on the bonded indebtedness and only $2,500 of this was derived from the revenues of the plant. This leaves $17,025.36 from the general taxation fund, or an annual cost of $40.54 per arc light. The cost of the plant to the city of Ashtabula for the years 1892 to 1898 is made up as follows: For operation, $60 per lamp; for interest on bonds, $40.54; for lost taxes, $9; total, $109.54 per lamp per year. This does not include the loss in county and State taxes, approximating $4.65 per annum. From 1898 to December 31, 1902, the cost was somewhat reduced. The operating expenses were $60 per annum. while interest charges were reduced to $31.45. The charge for lost taxes was $9.10, and, with loss in State and county taxes, $13.75, a total of $105.20. The cost to the taxpayers, for the six years ending 1898, is given as $685.14 per lamp; for the 4 years ending 1902, $292.28, a total for 10 years of $982.42, or an average cost per annum of $98.24 per light, and that on the moonlight schedule."

"M. S. T.," writing from New Bedford, Mass., under date of the 24th ult., says: "The Canadian Oil and Gas Company, organized at Augusta, Me., under the laws of that State, to deal in oils, residuals and gas, has filed a certificate of incorporation. It is capitalized in the sum of $100,000, and no part thereof has been paid in. Its promoters are: J. D. Thibodeau, Fall River, Mass.; Simeon L. Phillips, New Bedford, Mass.; Frank Westcott, Alden, N. Y.; J. Berry (President), L. L. Fairbanks and Lewis A. Burleigh, Augusta, Me., and A. M. French, of Winthrop, Me.

At the annual meeting of the shareholders in the Troy (N. Y.) Gas Company, the following Trustees were elected: A. Bleecker Banks, A. E. Bonesteel, Anthony N. Brady, Thomas Breslin, Fred. E. Draper, James Fleming, S. O. Gleason, George P. Ide, William Kemp, T. J. Mallory, Edward Murphy, Jr., R. C. Pruyn and C. E. Davenport.

A party named Dr. C. B. Darrin, a prominent factor in the operation of the American Tar Company, of Fairhaven and Whatcom, Washington, is anxious to secure a franchise for an opposition gas plant in Walla Walla, Wash. If he and his associates want to manufacture tar in Walla Walla, why do they not construct a coke oven plant, many types of which are on the market?

The following is from the Baltimore, Md., *Sun*, of the 24th ult.: "An order was passed yesterday by Judge N. Charles Burke, in the Circuit Court for Baltimore County, granting a temporary injunction to restrain Joseph Schreiber from laying gas mains along the streets, avenues and alleys in Highlandtown, Canton and Orangeville, and to show cause on or before November 23, why the injunction should not be made perpetual. The injunction was granted upon the filing of a bill of complaint by the Consolidated Gas Company, of Baltimore city, against the County Commissioners of Baltimore county and Joseph Schreiber. The bill sets forth that by Chapters 384 and 395 of the Acts of the General Assembly of Maryland passed in 1886 no gas companies shall be formed in Baltimore county, Baltimore city or Anne Arundel county, except the city of Annapolis, for the purpose of laying mains or selling gas; states that in June, Joseph Schreiber filed an application with the County Commissioners of Baltimore county for a franchise to lay mains in Highlandtown, Canton and Orangeville. Objections were made by the Consolidated Gas Company and a hearing given. The objections were overruled by the Commissioners and the franchise was granted. The bill asks that the attempted agreement may be by decree of court declared void and that an injunction be issued temporarily and perpetually restraining Joseph Schreiber from proceeding under the franchise. Immediately after the Board had given Mr. Schreiber permission to lay mains the Consolidated Company filed an appeal in the Circuit Court for Baltimore county from the decision of the Commissioners and the case was set for a hearing last Monday, but was dismissed by order of counsel for the Gas Company. Messrs. John P. Poe, J. Alexander Preston and George Whitelock are counsel for the Consolidated Gas Company, and Col. D. G. McIntosh for Mr. Schreiber. Mr. Schreiber claims that as an individual he has a right to the franchise."

Mr. James M. Hadden has resigned the Superintendency of the Poughkeepsie (N. Y.) Light, Heat and Power Company, to assume an important position with the Green Fuel Economizer Company, of Matteawan, N. Y. His connection with the Poughkeepsie Company was terminated the 31st ult., and his services thereto were of the most successful sort.

Mr. W. H. McGoldrick, of the Beaumont (Tex.) Gas Company, writing under date of the 25th ult., says: "You will note what Beaumont is to-day respecting the gas situation. This Company started as a natural gas system. Its wells were the best on the field, the pressure being over 360 pounds. The pressure soon played out. It now has two oil wells that were gas wells. One of them is now producing over 600 barrels of oil per day. It tried several wells for gas, but there never will be enough gas here to use. There will never be any trouble here, as the gas man puts it, from natural gas. I came over here last Christmas, when they were building an oil gas plant. It was started in February, but to start a gas business on that line costs too much to make the article. In fact, there was a gas machine, called the Climax, which was lighting a block, and did such good work that I gave it a trial. We turned the gas into our mains and the result was a better gas than we were making out of oil and far cheaper. It takes 2½ gallons, too, of 76-per cent. gasoline to make 1,000 cubic feet of gas. This gas is the cleanest I know of. Our lights, with a mantle, run from 150 to 300-candle power, and our heat will boil one gallon of water in 4 minutes; therefore, we are doing a land office business. We have 10 miles of mains. We have one building here in which we have over 40 gas heaters. We have no trouble with our stoves at all. Our mantles last a longer time. We were thinking of going back to oil, as gasoline was getting too high; 21 cents per gallon. We are getting it now from a refinery right here at 11 cents per gallon, in fact if we did go back to oil gas, or even make coal gas, we could not keep half of our lighting business, as 5 of our burners yield more light than 25 coal or oil gas burners, with a mantle. We are going to extend our system in all parts of the city, which will take over 20 miles of mains; people here are all after gas, although electricity is very cheap, ¼ cent per hour for 16-candle power lamp. Our price is 1 cent per hour for 75-candle power light, that will burn 3 feet of gas. You see we can then give 50 per cent. discount, and that will give us $1.66⅔ per 1,000 for our gas. Everyone is satisfied over this price. Our fuel is the same price as for lights. I was the first to make a price of this kind. Why I did it was to compete against the electric people. Now people know what they get in candle power, and so they are willing to pay for it."

Roxbury (Delaware county, N. Y.), wants a gas plant. Heretofore Roxbury's greatest claim to greatness is that it was the birthplace of that well remembered American financier, Mr. Jay, Gould.

The Morristown (N. J.) Gas Company is renewing its attempt to secure a franchise for the supply of Chatham.

A correspondent incloses the following from St. Louis, Mo., under date of the 28th ult.: "The St. Louis County Gas Company filed a petition in the county court at Clayton some days ago asking for a franchise to furnish gas for lighting, heating and for power to residents of the county, and particularly to the suburban towns southwest of St. Louis, including Webster Groves and Kirkwood. The Company was incorporated several days ago, with a capital of $100,000. It is the Company backed by the Laclede Gas Light Company of St. Louis. The promoters offer to file a bond of $5,000 within 30 days after the acceptance of the terms, to insure the county against loss, and to have at least 5 miles of mains in use within 18 months thereafter. The price of gas would be $1.20 per 1,000 cubic feet, with the addition of 10 per cent. after the date of discount. The Company is willing enough to bind itself to lay mains to any houses where at least one permanent consumer can be supplied for over 100 feet of pipe."

A correspondent sends this respecting recent gas doings at Albion, Mich.: "The shareholders of the Albion Gas Light Company have named the following officers for the ensuing year: Charles B. Kelsey, President; H. B. Wales, Vice-President; Charles E. Temple, Secretary; all of Grand Rapids; and E. P. Robertson, of Albion, Treasurer. These,

(*Continued on page* 694.)

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 42 Pine Street, New York.
Telephone, 2996 John.

TERMS:
SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 Cents.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.

NOTIFICATION RESPECTING ADVERTISING.
Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:
New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, NOVEMBER 2, 1903.

(*Concluded from page* 693.)

with Edward M Deane, of Grand Rapids, constitute the Board of Directors. Reports showed an increase in the business of 50 per cent. over that of the previous year and the Company is now installing a new holder which will triple the present capacity of the plant. Richard Schaddele is Manager."

Why Staybolts Break.

At the recent meeting in Chicago of the Master Steam Boiler Makers' Association, John Livingston, of Montreal, Canada, read a paper on the breaking of staybolts which contained some very practical observations. Following are his remarks in part:

Your chairman produced a board showing 171 heads of staybolts from the right side of the fire box on the fire side sheet of a locomotive; at least 75 out of the 171 were burned. You have held that the breakage of staybolts is due to expansion and contraction, and, being unable to counteract the expansion and contraction with the solid staybolt, the discussion centered on flexible staybolts. Too little heed was paid to the lesson taught on the board; too little consideration was given to the *prima facie* fact that the heads of 44 per cent. of those staybolts were burned.

The Mexican Central Railway Company state that they have had 30,000 flexible staybolts on trial for four years. They tell you they cost much more than the rigid bolts, that they are unsatisfactory, that they have just as many broken staybolts in the flexible, that they find it difficult to detect the broken staybolts, and that they are renewing with solid bolts as fast as they come to the shops for new boxes, and that for 90 engines on order they have specified rigid staybolts. That is an answer founded on the test of service which cannot be combated.

To avert the risk of burning from the inner end of the bolt outward there is only one way, and that is with air through the center of the bolt and the water around it. You cannot unduly expand a bolt of that character.

Given two locomotives stayed with good equal quality and equal sized staybolts, the locomotives put into service in the same locality under the same conditions and equally well cared for, the locomotive with the staybolt having the hole through its center will endure in service 20 per cent. longer, will steam better and burn less fuel. All solid staybolts are subject to the risks aforesaid. Those more or less crystallized are the cause of the greatest number of breakages in staybolts.

The Market for Gas Securities.

The market for city gas shares was dull this week, but the dullness was of the sort that denotes sullen strength. Now that Mr. Thomas, the short-term bank president, and Mister Burke Cochran, the mustard-tongued orator, have turned their attention to other affairs—the former to improving the breed of race horses and the latter towards the better sprinkling of churches on Long Island—the shorts in Consolidated seem to be without active leaders. "Anyhow" Consolidated seems to be improving from a public point of view, which improvement naturally will give Messrs. Stillman, Rockefeller, et. al., more confidence (?). The closing for Consolidated to-day (Friday) was 175 to 176. The Company has declared its regular quarterly dividend of 2 per cent., payable the 15th inst. Some inquiry came out for Mutual, but a bid of 310 failed to bring about a transfer. City gas bonds are in good demand.

Brooklyn Union is still quoted at nominal figures, but neither Hugh McLaughlin nor Mayor Low's brother have sold any stock at the quoted figures. People's, of Chicago, is increasing in value. At the quoted rates it is 20 points below its worth as an investment. Consolidated, of Baltimore, has secured a good advance, and Laclede (St. Louis) preferred is also on the increasing scale. Washington (D. C.) which is quoted at 292½ bid, is easily worth 50 points more.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

NOVEMBER 2.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	175	176
Central Union, Bonds, 5's.	3,000,000	1,000	104	106
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan	658,000	..	108	112
Mutual	3,500,000	100	280	295
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co..				
Bonds, 5's	11,000,000	1,000	103	105
Northern Union, Bonds, 5's.	1,250,000	1,000	105	106½
New York and East River				
Bonds 1st 5's	3,500,000	1,000	102	106
" 1st Con. 5's	1,500,000	..	109	111
Standard	5,000,000	100	135	140
Preferred	5,000,000	100	155	170
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	117
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	180	190
" " Bonds (5's)	15 000,000	1,000	119	119½
Bay State	50,000,000	50	⅛	¼
" Income Bonds	2,000,000	1,000	.	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	4	5
" " Bonds, 5's	5,250,000	1,000	73	76
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas & Elec. Co.	29,500,000	100	92½	92¾
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	101	101½
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¾	89¼
Preferred	3,026,500	100	107⅛	109
Consumers, Jersey City Bonds	600,000	1,000	100	102
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	62½	63
Mortgage, 6's	3,600,000	..	..	116
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	86	90
Consolidated G. & E. Co.'s.				
Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	87	95
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	381,000	1,000	77	79
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	85	..
Grand Rapids Gas Lt. Co.				
1st Mtg. 5's	1,255,000	1,000	104½	105
Hartford	750,000	25	245	255
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	50	65
" Bonds, 6's	2,650,000	..	103½	103½
Jackson Gas Co	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	79	90
Preferred	2,530,000	100	86½	..
Bonds	10,000,000	1,000	109½	110
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	136	140
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	107½	108½
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	184¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105¾
New Haven	1,000,000	25	220	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	94	94½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	15 800,000	100	..	..
St. Joseph Gas Co.				
" 1st Mtg. 5's	751,000	1,000	92	96½
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	46	48
Bonds	2,047,000	1,000	94	96
Washington, D. C	2,600,000	20	292½	300
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del	600,000	50	132	..

Advertisers' Index.

GAS ENGINEERS. Page

A. E. Boardman, New York City..... 712
Baxter & Young, Detroit, Mich..... 712
B. E. Chollar, St. Louis, Mo..... 698
David Leavitt Hough, New York City..... 712
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 704
Frank D. Moses, Trenton, N. J..... 698
Fred. Bredel Co., Milwaukee, Wis..... 700
Frederic Egner, Washington, D. C..... 696
Geo. R. Rowland, New York City..... 702
Humphreys & Glasgow, New York City..... 713
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 712
The Gas Machinery Co., Cleveland, O..... 699
The Jeffrey Manufacturing Co., Columbus, O..... 710
The Western Gas Construction Co., Fort Wayne, Ind.... 720
United Gas Improvement Co., Philadelphia, Pa..... 707
Wm. Henry White, New York City..... 715

GAS WORKS APPARATUS AND CONSTRUCTION.

A. E. Boardman, New York City..... 712
Bartlett, Hayward & Co., Baltimore, Md..... 713
Baxter & Young, Detroit, Mich..... 712
Christopher Cunningham, Brooklyn, N.Y..... 709
Connelly Iron Sponge and Governor Co., New York City 703
Continental Iron Works, Brooklyn, N. Y..... 714
Cruse-Kemper Co., Philadelphia, Pa..... 699
Davis and Farnum Mfg. Co., Waltham, Mass..... 712
Deily & Fowler, Philadelphia, Pa..... 716
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 704
Frank D. Moses, Trenton, N. J..... 698
Fred. Bredel Co., Milwaukee, Wis..... 700
G. Shepard Page's Sons, New York City..... 712
Humphreys & Glasgow, New York City..... 713
Isbell-Porter Company, New York City..... 714
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 712
Lloyd Construction Co., Detroit, Mich..... 702
Logan Iron Works, Brooklyn, N. Y..... 716
Quintard Iron Works, New York City..... 718
R. D. Wood & Co., Philadelphia, Pa..... 714
Riter-Conley Mfg. Co., Pittsburg, Pa..... 715
Stacey Mfg. Co., Cincinnati, O..... 715
The Connersville Blower Company, Connersville, Ind... 717
The Gas Machinery Co., Cleveland, O..... 699
The Jeffrey Manufacturing Co., Columbus, O..... 710
The Western Gas Construction Co., Fort Wayne, Ind.... 720
United Gas Improvement Co., Philadelphia, Pa..... 707

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md..... 713
B. E. Chollar, St. Louis, Mo..... 698
Economical Gas Apparatus Construct'n Co, Toronto, Ont. 704
Humphreys & Glasgow, New York City..... 718
The Gas Machinery Co., Cleveland, O..... 699
The Western Gas Construction Co., Fort Wayne, Ind.... 720
United Gas Improvement Co., Philadelphia, Pa..... 707

SCRUBBERS AND CONDENSERS.

Continental Iron Works, Brooklyn, N.Y..... 714
Economical Gas Apparatus Construct'n Co., Toronto Ont. 704
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 712
Logan Iron Works, Brooklyn, N. Y..... 716
R. D. Wood & Co., Philadelphia, Pa..... 714
Riter-Conley Mfg. Co., Pittsburg, Pa..... 715
Stacey Mfg. Co., Cincinnati, O..... 715
The Gas Machinery Co., Cleveland, O..... 699
The Western Gas Construction Co., Fort Wayne, Ind.... 720

PRODUCER POWER PLANTS.

Economical Gas Apparatus Construct'n Co., Toronto, Ont. 704
R. D. Wood & Co., Philadelphia, Pa..... 714

TAR AND CARBONIC ACID EXTRACTOR.

Economical Gas Apparatus Construct'n Co., Toronto, Ont. 704
Stacey Mfg. Co., Cincinnati, O..... 715
The Gas Machinery Co., Cleveland, O..... 699
The Western Gas Construction Co., Fort Wayne, Ind... 720

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich..... 709
The Gas Machinery Co., Cleveland, O..... 699
The Western Gas Construction Co., Fort Wayne, Ind... 720

GAS METERS.

American Meter Co., New York and Philadelphia..... 719
Detroit Meter Company, Detroit, Mich..... 719
D. McDonald & Co., Albany, N.Y..... 717
Helme & McIlhenny, Philadelphia, Pa..... 719
John J. Griffin & Co., Philadelphia, Pa..... 680
Keystone Meter Co., Royersford, Pa..... 718
Maryland Meter and Mfg. Co., Baltimore, Md..... 718
Metric Metal Co., Erie, Pa..... 719
Nathaniel Tufts Meter Co., Boston, Mass..... 718

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia..... 719
D. McDonald & Co., Albany, N. Y..... 717
Helme & McIlhenny, Philadelphia, Pa..... 719
John J. Griffin & Co., Philadelphia, Pa..... 680
Keystone Meter Co., Royersford, Pa..... 718
Nathaniel Tufts Meter Co., Boston, Mass..... 718

PREPAYMENT METER ATTACHMENTS.

Reeves Mfg. Co., New Haven, Conn..... 700

GAS AND WATER PIPES.

Christopher Cunningham, Brooklyn, N.Y..... 709
Davis & Farnum Mfg. Co., Waltham, Mass..... 712
Donaldson Iron Co., Emaus, Pa..... 704
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 704
M. J. Drummond & Co., New York City..... 704
R. D. Wood & Co., Philadelphia, Pa..... 714
Warren Foundry and Machine Co., New York City..... 704

NON-RUSTING PIPE LUBRICANT.

Alan H. Tripp, Chicago, Ills..... 700

GAS COALS.

Berwind-White Coal Mining Co., New York and Phila. 710
Perkins & Co., New York City..... 710
Westmoreland Coal Co., Philadelphia, Pa..... 711

SPECIALTIES FOR OIL AND PIPE LINES.

S. R. Dresser, Bradford, Pa..... 701

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., N.Y. City..... 704

GAS TAPPING MACHINES.

George Light, Dayton, O..... 704
H. Mueller Manufacturing Company, Decatur, Ills..... 701

CANNEL COALS.

Perkins & Co., New York City..... 710

STOKING MACHINERY.

G. A. Bronder, New York City..... 709

AUTOMATIC WEIGHING MACHINERY.

Richardson Scale Co., New York City..... 700

CONVEYORS.

C. W. Hunt Company, New York City..... 701
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 704
G. A. Bronder, New York City..... 709
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 712
The Gas Machinery Co., Cleveland, O..... 699
The Jeffrey Manufacturing Co., Columbus, O..... 710
The Link-Belt Machinery Co., Chicago, Ills..... 711
The Western Gas Construction Co., Fort Wayne, Ind... 720

CHARGING BARROWS & COAL WAGONS.

Kerr Murray Mfg. Co., Fort Wayne, Ind..... 712
Stacey Mfg. Co., Cincinnati, O..... 715

GAS ENRICHERS.

Standard Oil Co., New York City..... 711
The Sun Oil Co., Pittsburg, Pa..... 711

COKE CRUSHERS.

C. M. Keller, Columbus, Ind..... 711
The Jeffrey Manufacturing Co., Columbus, O..... 710

STEAM BLOWER FOR BURNING BREEZE.

The Connersville Blower Company, Connersville, Ind... 717

ECONOMIZERS.

Green Fuel Economizer Co., Matteawan, N.Y..... 702

GAS GAUGES.

The Bristol Co., Waterbury, Conn..... 702

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City 703
Isbell-Porter Co., New York City..... 714
R. D. Wood & Co., Philadelphia, Pa..... 714

CEMENTS.

C. L. Gerould, Galesburg, Ills..... 708

RETORTS AND FIREBRICKS.

Adam Weber Sons, New York City..... 708
Baltimore Retort and Firebrick Co., Baltimore, Md..... 708
Brooklyn Firebrick Works, Brooklyn, N. Y..... 708
Henry Maurer & Son, New York City..... 708
James Gardner, Jr., Co., Pittsburg, Pa..... 708
J. H. Gautier & Co., Jersey City, N. J..... 708
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 708
Missouri Firebrick Co., St. Louis, Mo..... 708
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 698
The Kreischer Brick Mfg. Co., New York City..... 708

INCLINED RETORTS.

Adam Weber Sons (Graham, Morton [England] System) 708
Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System) 703
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 698

VERTICAL S'S.

Adam Weber Sons (Oscar B. Weber's Construction)..... 708
Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System) 703
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 698

REGENERATIVE FURNACES.

Adam Weber Sons, New York City..... 708
Bartlett, Hayward & Co., Baltimore, Md..... 703
Fred. Bredel Co., Milwaukee, Wis..... 700
J. H. Gautier & Co., Jersey City, N.J..... 708
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 708
Missouri Firebrick Co., St. Louis, Mo..... 708
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 698

SELF-SEALING MOUTHPIECE DOORS.

Continental Iron Works, Brooklyn, N.Y..... 714
Isbell-Porter Co., New York City..... 714
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 712
Logan Iron Works, Brooklyn, N.Y..... 716
R. D. Wood & Co., Philadelphia, Pa..... 714
Stacey Mfg. Co., Cincinnati, O..... 715
The Gas Machinery Co., Cleveland, O..... 699
The Western Gas Construction Co., Fort Wayne, Ind... 720

CHIMNEY CONSTRUCTION.

Adam Weber Sons, New York City..... 708

INCANDESCENT GAS LAMPS.

Ball Check Light Co., New York City..... 698
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 700
General Gas Light Co., Kalamazoo, Mich..... 699
Lindsay & Co., Chicago, Ills..... 697
Welsbach Company, Gloucester, N. J..... 706

BURNERS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 700
Wm. M. Crane Co., New York City..... 701

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 700

STREET LAMPS.

Thos. T. W. Miner, New York City..... 701
Welsbach Street Lighting Co., New York and Phila.... 706

PURIFIERS.

Connelly Iron Sponge and Governor Co., New York City. 703
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 712
R. D. Wood & Co., Philadelphia, Pa..... 714
Stacey Mfg. Co., Cincinnati, O..... 715
The Western Gas Construction Co., Fort Wayne, Ind... 720

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City 703

VALVES.

Continental Iron Works, Brooklyn, N. Y..... 714
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 704
Isbell-Porter Co., New York City..... 714
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 712
Ludlow Valve Manufacturing Co., Troy, N.Y..... 701
R. D. Wood & Co., Philadelphia, Pa..... 714
Stacey Mfg. Co., Cincinnati, O..... 715
The P. H. & F. M. Roots Co., Connersville, Ind..... 663
The Western Gas Construction Co., Fort Wayne, Ind.... 720

EXHAUSTERS.

Connelly Iron Sponge and Governor Co., New York City 703
Isbell-Porter Company, New York City..... 714
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 712
The Connersville Blower Company, Connersville, Ind... 713
The P. H. & F. M. Roots Co., Connersville, Ind..... 663

ELECTRICAL APPARATUS.

Wm. Henry White, New York City..... 715

PURIFIER SCREENS.

John Cabot, New York City..... 700

GAS STOVES.

American Meter Co., New York and Philadelphia..... 705
Keystone Meter Co., Royersford, Pa..... 718
Maryland Meter and Manufacturing Co., Baltimore, Md. 718
Nathaniel Tufts Meter Co., Boston, Mass..... 718

HOT WATER HEATERS.

The Humphrey Mfg. and Plating Co., Kalamazoo, Mich. 704

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N.Y..... 702

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 713
Continental Iron Works, Brooklyn, N.Y..... 714
Cruse-Kemper Co., Philadelphia, Pa..... 699
Davis & Farnum Mfg. Co., Waltham, Mass..... 712
Deily & Fowler, Philadelphia, Pa..... 716
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 704
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 712
Logan Iron Works, Brooklyn, N Y..... 716
R. D. Wood & Co., Philadelphia, Pa..... 714
Riter-Conley Mfg. Co., Pittsburg, Pa..... 715
Stacey Mfg. Co., Cincinnati, O..... 715

STORAGE TANKS.
Christopher Cunningham, Brooklyn, N.Y..... 709
Stacey Mfg. Co., Cincinnati, O..... 715

PAINTS.
National Paint Works, New York City..... 712

AUTOMATIC SCALES.
Richardson Scale Co., New York City..... 700

INVESTORS.
W. R. Faben Construction Company, Toledo, O..... 700

PATENTS, TRADE-MARKS, COPYRIGHTS.
Royal E. Burnham, Washington, D. C..... 700

BOOKS, ETC.
Scientific Books..... 696
Self-Instruction for Students in Gas Manufacture 701
Finances of Gas and Electricity Mfg. Enterprises..... 701
Practical Handbook on Gas Engines..... 700
Hughes' "Gas Works"..... 710
Electric Gas Lighting..... 700
Coal Tar and Ammonia..... 710
Gas Analyst's Manual 716
Field's Analysis, 1902..... 718
Gas Flow Computers..... 711
Excerpts from Reports of Gas Commissioners..... 679
Directory of Gas Companies..... 715
Gas Engineer's Laboratory Handbook..... 714
Gas Engineer's Pocket-Book..... 708
Poole on Fuels..... 711
Binders..... 711

Situation Wanted.

EXPERIENCED MANAGER, thoroughly familiar with every depar ment of the business, coal or water gas. Successful in economical operation and development of new business. Can guar ntee results. Energetic and progressive. Good record.
Address, "DIVIDENDS,"
1476-8 Care this Journal.

Situation Wanted

As Manager or Superintendent of Small Coal or Water Gas Plant,

By a man 45 years old. Successful and economical in operation and up to developing new business. Thoroughly practical and experienced in all branches. Progressive. First-class references given. Address, "S.,"
1471-tf Care this Journal.

WANTED,

For a company now producing about 15,000,000 cubic feet yearly, a **First-Class Superintendent,** who must be a practical gas and business man, capable to take charge of and develop the business. Good position for the proper party. Address, "S.,"
1482-1 Care this Journal.

WANTED,

A Competent Meter Repairer.

Permanent employment. Apply, giving references, to the LAFAYETTE GAS CO.,
1480-4 LAFAYETTE, IND.

WANTED,

A Competent Gas Maker for Lowe Apparatus,

By a gas company in Western Illinois. Apply, giving references and salary expected, to
1476-tf "GAS MAKER," care this Journal.

FOR SALE—CHEAP.

Four Purifiers, 8 by 8 by 3 feet, for 8-inch connections.
One P. & A. Tar Extractor, 8 inch connections.
One 6-Inch Steam Jet Exhauster.
Six 6-Inch Gate Valves.

All of the above are in good condition and will be sold at a low figure. Address,
LANSING GAS LIGHT CO.,
1482-3 LANSING, M CH.

FOR SALE.

Two Rectangular, Cast Iron, Water Tube Condensers, 5 feet 6 inches wide, by 15 feet 10 inches high, by 36 feet 10 inches long, with 20-inch valves and connections.
One Rectangular, Cast Iron Scrubber, 5 feet 6 inches wide, by 12 feet high, by 36 feet 10 inches long, with 20-inch valves and connections.
Sixteen Sections of Cast Iron Hydraulic Main, 8 feet 4 inches long by 24 inches, for benches of 6's; dip and bridge pipes; 7-inch ascension pipes; supports for hydraulic main; 4 take-off ends, with 12 inch outlets; adjustable valves, with Hutchison tar draw-off pots.
Seventy-eight Self-Sealing Mouthpieces, each 18 by 24.
One Fuller Vertical Engine, 8 by 12, with exhauster governor.
One Fuller Vertical Engine, 9 by 14, with exhauster governor.
One McKenzie Exhauster, 16-inch valves and connections.
One Wilbraham Exhauster, 16-inch valves and connections.
One 12-Inch By-Pass, with Smith & Sayre compensator; 6-inch connections.
One P. & A. Tar Extractor, 1,000,000 cubic feet capacity; 16-inch connections
One Wrought Iron Tower Scrubber, 6 feet diameter by 29 feet 6 inches high; 16-inch valves and connections.
Two Wrought Iron Scrubbers, 7 feet diameter by 16 feet high, with 16-inch valves and connections.
Three Wrought Iron Condensers, each 6 feet diameter by 16 feet high, with 16-inch valves and connections.
Two Standard Washer-Scrubbers, No. 13, with 20-inch valves and connections.

All the above apparatus, if examined at once, can be seen connected and in operation. It will be removed to give room to larger apparatus. Any further information can be obtained from the PROVIDENCE GAS COMPANY,
1462-tf Providence, R. I.

FREDERIC EGNER,
Gas Engineer,
WASHINGTON BANK BUILDING, 12TH & G STS., N. W., WASHINGTON, D. C.,

May be consulted with reference to estimates of cost for new, or appraising actual value of existing works; utility of proposed or patented processes; relative earning power to capitalization, and management. Will NOT undertake to furnish apparatus or material, or to contract for the erection of works.

SCIENTIFIC BOOKS.

ELECTRIC GAS LIGHTING. By H. S. Norrie. 50 cents.

GAS ANALYST'S MANUAL. By J. Abady. $6.50.

COX'S GAS FLOW COMPUTER. $2.50.

FIELD'S ANALYSIS, 1902. $5.

HUGHES' GAS WORKS. $1.65.

POOLE ON FUELS. By Herman Poole. $3.

GAS ENGINEER'S POCKET-BOOK. By Henry O'Connor $3.50.

TECHNICAL GAS ANALYSIS. By Winkler & Lunge. $4.

GAS CONSUMER'S HANDYBOOK, by Wm. Richards. 20 cents.

PRACTICAL TREATISE ON HEAT. By Thomas Box. 3d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*, $5. Vol. II., *Lighting*, $4.

IRONWORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

HEMPEL'S GAS ANALYSIS, $2.25.

SELF-INSTRUCTION FOR STUDENTS IN GAS MANUFACTURE. $1.25.

LIQUID FUEL FOR MECHANICAL AND INDUSTRIAL PURPOSES. By E. A. Brayley Hodgetts. $2.50.

PRACTICAL HANDBOOK ON GAS ENGINES, by G. Lieckfeld. $1.

HEAT A MODE OF MOTION. By John Tyndall. $2.50.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

MANUAL FOR GAS ENGINEERING STUDENTS. By D. Lee. 40 cents.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

TREATISE ON MASONRY CONSTRUCTION. Baker. $5.

GAS ENGINEER'S LABORATORY HANDBOOK. By Jno. Hornby. $2.50.

FINANCES OF GAS AND ELECTRICITY MANUFACTURING ENTERPRISES. By Wm. D. Marks. $1.

PRACTICAL PLUMBING. By P. J. Davies. Vol. I. $3, Vol. II. $4.50.

AMERICAN PLUMBING. By Alfred Revill. $2.

A COMPARISON BETWEEN THE ENGLISH AND FRENCH METHODS OF ASCERTAINING THE ILLUMINATING POWER OF COAL GAS. $1.60.

ELECTRICITY.

INDUSTRIAL PHOTOMETRY, with Special Application to Electric Lighting. By A. Palaz, Sc.D. $4.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Kapp. $3.50.

ELECTRICIAN'S POCKET-BOOK. By Monroe and Jamieson. $2.50.

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By E. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATED WIRES AND CABLES. $1.

ELECTRIC LIGHTING, by Francis B. Crocker. $3.

ELECTRIC LIGHT FITTING. $2.

PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

ELECTRICITY, Its Theory, Sources and Applications. By John T. Sprague. $6.

The above will be forwarded upon receipt of price. If sent by mail or express, postage or express charges must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order. No books sent C.O.D.

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK.

LINDSAY & CO.,

CHICAGO, U. S. A.

SPECIAL FOR
GAS COMPANIES.

"Lindsay"

3-Burner

Arc Lamp.

300-Candle Power.

Consumes but 10 cubic feet of gas per hour and can be attached to any gas fixture.

Finished in Oxidized Brass.

Equipped with Adjustable Gas Regulators.

No Chimneys to Break.

NO PIPING OR EXPENSE FOR INSTALLATION.

SATISFACTION GUARANTEED.

Handsome in Appearance. Efficient in Operation.

SOLD ON 30 DAYS' TRIAL.

SPECIAL.

On request, we will send to any Gas Companies in the United States, express prepaid, who have not tried the 3-BURNER LINDSAY ARC LAMPS, one or more, complete, with "Gasco Arc" mantles and glassware, on 30 days' trial. $2 dollars each. :: :: :: :: ::

SAMPLE
BALL CHECK
By Mail
(To Dealers)
For a Dime.
They Sell For
A Quarter.

BOOKLET
OF OUR
GAS ARC
LAMPS
for the
Asking.

PARKER-RUSSELL MINING AND MFG. CO.,

PROPRIETORS OF THE

OAK HILL GAS RETORT AND FIREBRICK WORKS.

St. Louis Office: 417 Pine Street. New York Office: Aldrich Court, 45 Broadway.

WE MAKE A SPECIALTY OF WATER GAS LININGS AND CHECKER BRICK.

Half and Full Depth Benches of Our Own Design, Containing 6, 8 or 9 Retorts.

SLOPERS—We have perfected plans of INCLINED RETORT BENCHES, designed to meet conditions prevailing in America, and constructed entirely of American materials.

We Build Benches Complete, Ready for Gas Making. Also

RETORT HOUSES,

COAL and COKE CONVEYING MACHINERY.

Plans, Specifications and Estimates Cheerfully Furnished.

CORRESPONDENCE SOLICITED.

FRANK D. MOSES,

Long Distance Telephone, 1922, Trenton, N. J.

TRENTON, N. J.,

Long Distance Telephone, 1922 Trenton, N. J.

Constructing Engineer and Contractor.

Estimates Furnished on any kind of Work in Connection with Gas or Water Plants.

SPECIAL ATTENTION GIVEN TO THE REMODELLING AND EXTENDING OF THE PROPERTIES OF WORKS NOT UP-TO-DATE.

CORRESPONDENCE SOLICITED.

Chollar's System of Gas Purification.

THE PURIFIED GAS REVIVES THE FOULED OXIDE.

The Gas Engineer's Laboratory Handbook,

By JOHN HORNBY, F.I.C.

Price, $2.50.

A. M. CALLENDER & CO., 42 Pine St., N. Y. City.

The Light that's Right.

THE HUMPHREY GAS ARC LAMP.

Place orders early. Our factory is now running overtime.

General Gas Light Company,

Kalamazoo, Mich.

NEW YORK BRANCH, - - - 54 Warren Street.
SAN FRANCISCO BRANCH, 530 Market Street.

Order from Nearest Place.

ARTHUR R. CRUSE, President. FRANK FLAVELL, Secretary. AARON E. KEMPER, Treasurer.

Cruse=Kemper Company,

PHILADELPHIA OFFICES: Stephen Girard Building. - - WORKS: Ambler, Pa.

Manufacturers of

Triple, Double and Single=Lift Gasholders,

With or Without Metal Tanks,

Oil and Water Tanks, Purifier Covers, General Plate Metal Work, and Steel Water Towers.

Plans, Specifications and Estimates Promptly Furnished on Request.

P. PLANTINGA, President. W. E. STEINWEDELL, Secretary.

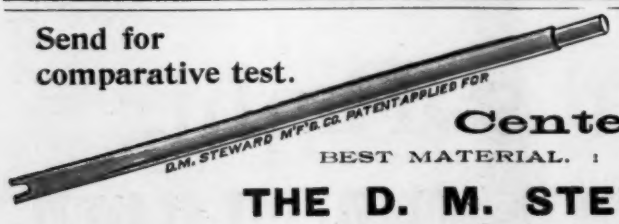
THE GAS MACHINERY CO.,

OFFICES: 720-722 CITIZENS BUILDING,

CLEVELAND, OHIO.

Coal and Water Gas Apparatus, Bye-Product Machinery, Structural Work and Connections.

Send for comparative test.



LAVITE
(TRADE MARK)
Center-Supports.
BEST MATERIAL. : : : : : : ACCURATELY MADE.

Lessens vibrations. Never bends.

THE D. M. STEWARD MFG. CO., (ESTABLISHED 1876.

NEW YORK: 8–12 Jay Street. CHICAGO: 57 Washington Street. FACTORY AND GENERAL OFFICE: Chattanooga, Tenn. 3

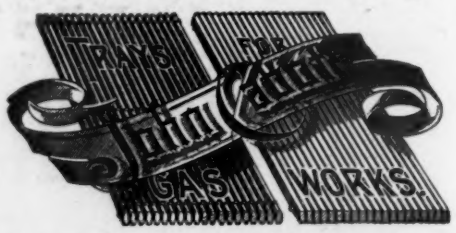
Utilize Your Gas Liquor.
NO EXTRA LABOR OR OPERATING EXPENSES.
IMPROVED AMMONIA CONCENTRATOR.
About 100 in use. Write to
STROH & OSIUS, Patentees, or
MICHIGAN AMMONIA WORKS, - Detroit, Mich.

IN THE MARKET.
WE PURCHASE:
Gas properties,
Electric light properties.
Street railway properties.
Also desirable franchises.
W. R. FABEN CONSTRUCTION CO.,
1388-tf 317 St. Claire Street, Toledo, O.

PATENTS, TRADE-MARKS, COPYRIGHTS.
ROYAL E. BURNHAM,
Solicitor of Patents and Counsellor in Patent Causes.
833 Bond Building, Washington, D. C.
Send for Pamphlet on Patents.
1418-tf

AUTOMATIC
Send for Catalogue.
SCALES
RICHARDSON SCALE CO., 21 Park Row, NEW YORK CITY.

Church's Patent Trays.
Reversible; Strongest; Most Easily Repaired.
Special Trays for Iron Sponge.



1412-1416 Adams Street, Hoboken, N. J.
We also Supply the Chapest and Strongest
•Reversible Bolted Trays•
IN THE MARKET.
SEND FOR BOOKLET AND CIRCULARS.

ORDER

The **REEVES PREPAYMENT ATTACHMENT** sent to your meter manufacturers; they will attach them. Or order from us and attach them yourselves. The Reeves Prepay has advantages possessed by no other. Ten hours' warning to consumers. Can't be "beaten." Simple. Low price. Now being used by scores of the largest gas companies. Write for sample and descriptive matter.

REEVES MFG. CO., - - - NEW HAVEN, CONN.

A FREE OFFER.

To any Gas Company, on request, I will send a 6-lb. package of **TRIPP'S NON-RUSTING PIPE LUBRICANT,** unexcelled for Gas, Steam and Water Pipe Joint Threads. (You pay express charges only.)

"Non-Rusting" is used by many Gas Companies. I refer to Peoples Gas Light and Coke Co., Chicago; Bloomington Gas Co., Bloomington, Ills.; Canton Gas Co., Canton, Ills., Augusta Gas Co., Augusta, Ga.; Peoples Gas Co., Rutland, Vt., Etc., Etc.

ALAN H. TRIPP, 177 East 40th St., Chicago, Ills., Sole Manufacturer.
"ONCE USED, ALWAYS USED."

ELECTRIC GAS LIGHTING.
How to install electric gas igniting apparatus, including the jump spark and multiple systems for use in houses, churches, theaters, halls, schools, stores or any large building. Also, the care and selection of suitable batteries, wiring and repairs.
By H. S. NORRIE.
Price, 50 Cents. Orders may be sent to
A. M CALLENDER & CO., - - - 42 PINE STREET, NEW YORK CITY.

GAS ANALYST'S MANUAL,
By JAQUES ABADY, M. Inst. Mech. E.
(Incorporating F. W. Hartley's "Gas Analyst's Manual" and "Gas Measurement.")
Ninety-three Illustrations and Nine Folding Plates. Bound in Handsome Half Leather. Price, $6.50.
For Sale by **A. M. CALLENDER & Co., 42 Pine St., New York City.**

FRED. BREDEL, President. WM. O. VILTER, Vice-President. O. W. GREENSLADE, Secretary and Treasurer.
FRED. BREDEL COMPANY,
ENGINEERS AND BUILDERS OF GAS PLANTS.
Inclined Benches, own system, Recuperative Furnaces, Exhausters, Exhauster Governors, Condensers, Washers, Coolers, Wet Purifying Plants, Purifiers, Oxide Elevators, Hydraulic and Dry Coke Conveyors.
Special High Grade Material for Recuperative Furnaces.
Licensees for ARROLL-FOULIS Charging and Discharging Machines and FRONHAUSER Coke Conveyors. OFFICE, 405 KEENE ST., MILWAUKEE, WIS.

PRACTICAL HANDBOOK ON GAS ENGINES, WITH INSTRUCTIONS FOR CARE AND WORKING OF THE SAME,
By G. LIECKFELD, C.E. Translated with Permission of the Author, by GEO. M. RICHMOND, M.E. Price, $1.00.
A. M. CALLENDER & CO., 42 PINE ST., NEW YORK CITY.

BRAY BURNERS

Are made under U. S. Patents.
We warn Gas Companies and Dealers against infringements.
All Burners are stamped with name and trade mark.

WILLIAM M. CRANE CO.,
SOLE AGENTS FOR U. S.,
1188 Broadway, New York.

"THE MINER"

Globe
Street and Boulevard
Lamps.
Cheapest and Best.
THOUSANDS IN USE WITH INCANDESCENT BURNERS.
Send for Catalogues.

THOMAS T. W. MINER,
821-823 Eagle Av., N.Y.

COAL HANDLING MACHINERY.

ESTABLISHED 1872.

We have designed and built a great variety of hoisting masts and elevators of both wood and steel construction, that can be seen in operation in almost every city and port in America.

Our latest record is unloading coal from a barge and depositing it in the coal pockets at the rate of 320 tons per hour.

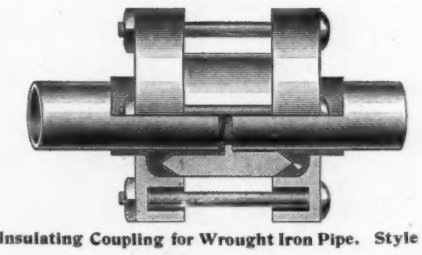
Write for Catalog 0011.

C. W. HUNT COMPANY,
New York Office: 45 Broadway. WEST NEW BRIGHTON, N. Y.

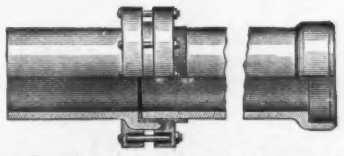
S. R. DRESSER,

BRADFORD, PENNSYLVANIA, U. S. A.,

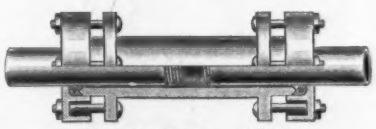
Patentee and Manufacturer of Specialties for Oil and Gas Lines.



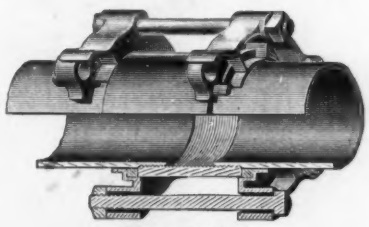
Insulating Coupling for Wrought Iron Pipe. Style 5.



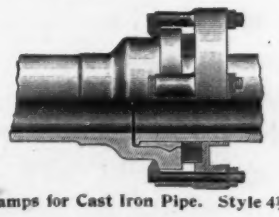
Insulating Coupling for Dresser Bell and Spigot Cast Iron Pipe. Style 6.



Regular Sleeve. Style 2.



Clamp. Style 4.



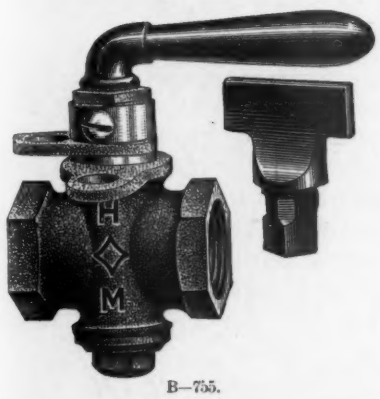
Clamps for Cast Iron Pipe. Style 4½.

Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

My Insulating Coupling prevents the destruction of pipe by electrolytic action, in either water or gas lines.

SEND FOR CATALOGUE.

Mueller Gas Cocks.



B—755.

TOO little is not as much as you pay for, and too much is more paid for than you need.

In **Mueller Gas Cocks** you find a happy medium--not so little metal as to leave them weak, nor yet so much as to make them costly.

Made in 145 styles, seven sizes in each style.

MADE ONLY BY

H. MUELLER MFG. CO.,
DECATUR, ILLS., U. S. A.

THE

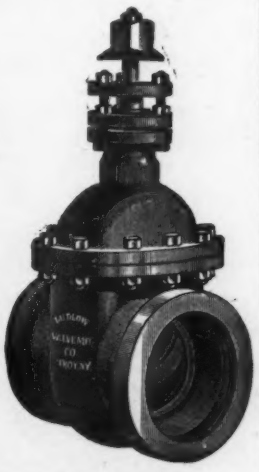
Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

Double and Single Gate Valves, ¼" to 72",

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.



HOT GAS VALVES A SPECIALTY

Send for Catalogue.

SELF-INSTRUCTION

For Students in Gas Manufacture.

Price $1.25. For Sale by

A. M. Callender & Co.,
42 Pine Street, New York City.

FINANCES OF

Gas and Electricity Manufacturing Enterprises,

By WM. D. MARKS Price $1. For Sale by

A. M. Callender & Co.,
42 Pine Street, New York City.

LLOYD CONSTRUCTION COMPANY,

DETROIT, MICH.

LOWE DOUBLE SUPERHEATER WATER GAS APPARATUS.

Coal Gas Condensing and Scrubbing Apparatus.
Purifiers with Plain or Reversing Center Valves.
The Lloyd System of Valve Connections.
PLAIN OR REVERSING (PATENT APPLIED FOR).
Oxide, Coal and Coke Elevators and Machinery.
Pipe Specials, all sizes. A. G. L. Asn. Standard.
Structural Steel Work, Floors, Angle and Gate Valves.

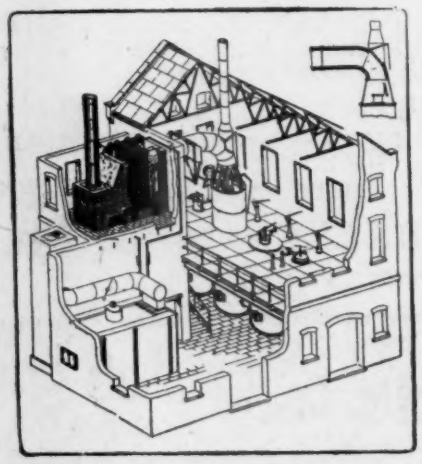
General Western Agents for BARTLETT, HAYWARD & CO., Baltimore, Md.

COAL GAS CONDENSATION SYSTEM. THE "MAYER" PATENTED TAR EXTRACTOR. THE STANDARD ROTARY WASHER-SCRUBBER. STETTIN SYSTEM INCLINED BENCHES, HYDRAULIC VALVES, ETC., ETC.

Economize Heat in Water Gas Plants,

BY UTILIZING A

Green's Economizer,



To absorb the heat now going to waste when you blow through your superheater to heat the feed water for your boilers to the temperature of the steam. This is now being done at the Poughkeepsie Gas Works, Poughkeepsie, N. Y. : : : : :

Write for full particulars how this is accomplished, the saving effected, and the advantages gained, to the

GREEN FUEL ECONOMIZER CO.,

MATTEAWAN, N. Y.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE.

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,

238 Java Street, Brooklyn, N. Y.

GEORGE R. ROWLAND,

Formerly with the Continental Iron Works.

Draughtsman and Constructing Engineer.

Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.

Office, No. 245 Broadway, N. Y. City.

Bristol's Recording

PRESSURE GAUGE.

For continuous records of **Street Gas Pressure.** Simple in construction, accurate in operation and low in price.

Fully Guaranteed. Send for Circulars.

THE BRISTOL CO.,

Waterbury, Conn.

Silver Medal, Paris Exposition.

Gas Analyses of All Sorts and Conditions

—OR—

Analyses of Solid and Liquid Materials as Well,

That are needed by Gas Companies at any time in the conduct of their business, may be obtained from

DR. W. H. BIRCHMORE,

1421-tf 341 ADELPHI ST., BROOKLYN, N. Y.

Gas Engineer's Pocket-book, —BY— HENRY O'CONNOR.

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works. PRICE, $3.50. For Sale by

A. M. CALLENDER & CO., 42 Pine St., N.Y. City.

The Advertisement of the

P. H. & F. M. ROOTS CO., Mfrs. of Gas Exhausters, Blowers, etc.,

Connersville, Ind., - - - 120-122 Liberty Street, New York City,

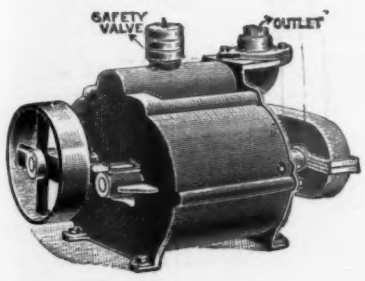
Occupies this Space Every Alternate Week.

Connelly Iron Sponge and Governor Co.,

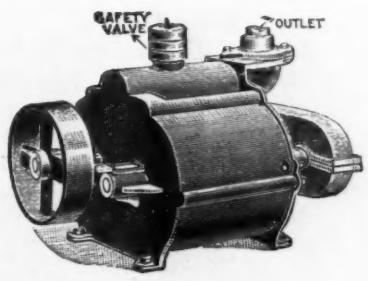
395 Broadway, New York City.

TELEPHONE, 3033 Franklin. - - - CABLE ADDRESS, Governorco.

GEO. G. RAMSDELL, General Manager. S. F. HAYWARD, Treasurer.

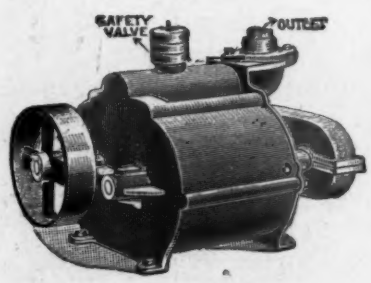


REVIVIFYING IN SITU.



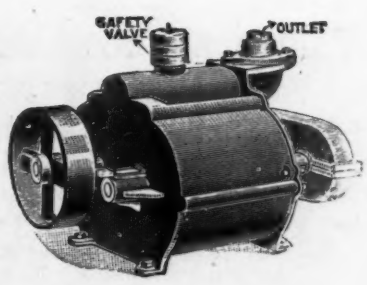
An inexpensive device for admitting air into purifying boxes. Belted direct to exhauster shaft the speed of blower is automatically regulated. Size shown in cut, 10 inches by 10½ inches by 16 inches, has a capacity of 172 cubic inches per revolution, and can be speeded to admit percentage of air desired. Specially designed for gas companies. A large number of these machines are now in daily use, giving entire satisfaction.

CORRESPONDENCE SOLICITED.



Connelly Iron Sponge and Governor Co.,

395 BROADWAY, NEW YORK CITY.



"GLOBE" SPECIALS, VALVES, ETC. "GLAMORGAN" PIG IRONS

M. J. DRUMMOND & CO.

MANUFACTURERS OF

CAST IRON

FLANGE

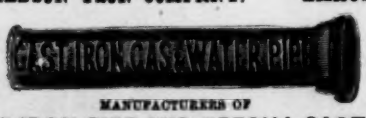
GAS AND WATER PIPE

GENERAL SALES OFFICE, 192 BROADWAY, NEW YORK.

GEORGE ORMROD, Mangr. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.



MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES

—FOR—

Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

Send for Circulars.

Geo. Light,
DAYTON, O.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,

Consulting Engineers.

Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::

PLANS, SPECIFICATIONS AND ESTIMATES PREPARED.

AMERICAN OFFICE:
269 Front St., East, Toronto, Canada.

THE

Valuation of Gas, Electricity and Water Works

FOR ASSESSMENT PURPOSES.

THOS. NEWBIGGING, M.Inst.C.E., and WM. NEWBIGGING, Assoc.M.Inst.C.E.

With an Appendix of Decided Cases.

Second Edition. Price $2. For Sale by

A. M. CALLENDER & CO.,
42 Pine Street, N. Y. City.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

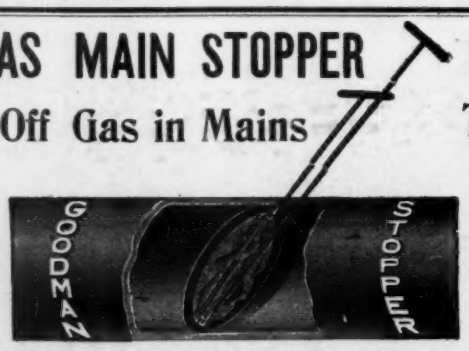
FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

SAFETY GAS MAIN STOPPER COMPANY,

For Shutting Off Gas in Mains

Any size gas main can be shut off in 30 seconds. : : :



Temporarily during alterations and repairs. : : : :

STOPPERS SENT ON TRIAL.

Address: SAFETY GAS MAIN STOPPER CO., 108 E. 117th St., New York City.

THE No. 8

Humphrey Crescent Instantaneous Water Heater

IS A QUICK SELLER.

PRICE,

$20.00.

SHELF AND BRACKET FREE.

HAS NO EQUAL AT THE PRICE.

TRY ONE AND BE CONVINCED. WILL SEND ON 60 DAYS' APPROVAL.

HAVE YOU OUR CATALOGUE?

The Humphrey Mfg. and Plating Co.,

KALAMAZOO, MICH., U. S. A.

The Gas Engineer's Laboratory Handbook,

By JOHN HORNBY, F.I.C.

Price, $2.50.

FOR SALE BY

A. M. CALLENDER & CO.,
42 Pine Street, New York City.

Practical Handbook on

GAS ENGINES,

With Instructions for Care and Working of the Same,

By G. LIECKFELD, C.E.

Translated with Permission of the Author, By GEO. M. RICHMOND, M.E.

Price, $1. For Sale by

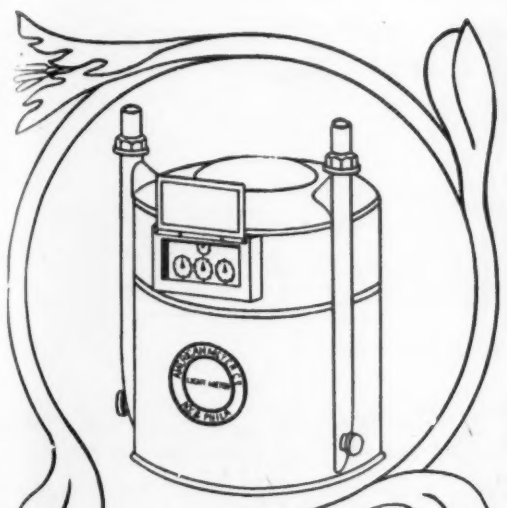
A. M. CALLENDER & CO.,
No. 42 Pine Street, New York City.

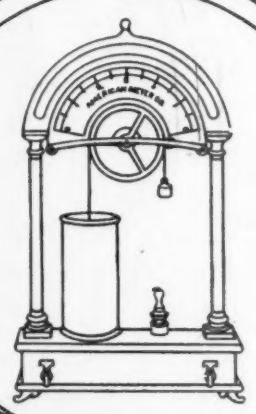
(Copyrighted, 1894, by the AMERICAN METER CO.)

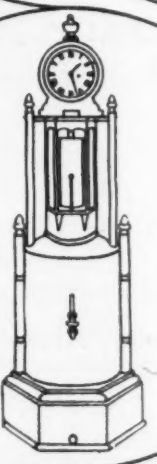
AMERICAN METER CO.

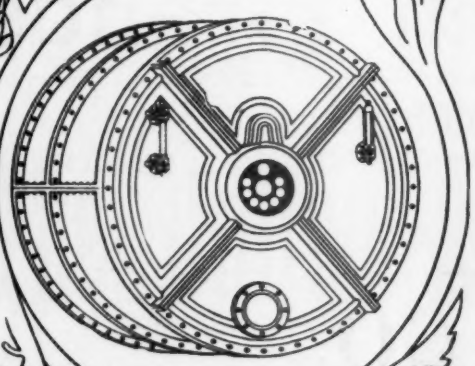
ESTABLISHED 1834. INCORPORATED 1868.

NEW YORK,
PHILADELPHIA,
CHICAGO,
ST. LOUIS,
SAN FRANCISCO.





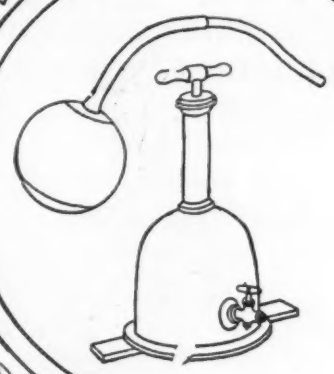


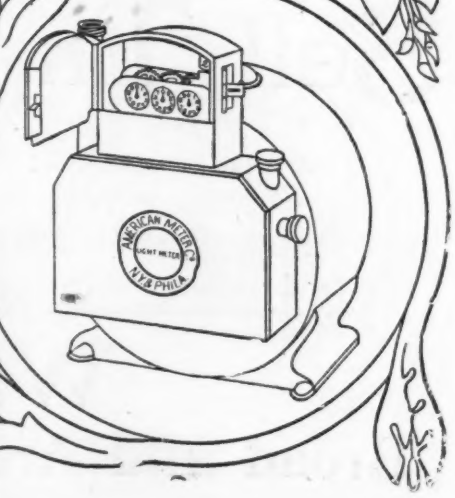


PUBLIC LIGHTING TABLE.

NOVEMBER, 1903.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Sun.	1	2.40 AM	5.30 AM	4.45	5.35
Mon.	2	3.40	5.30	4.45	5.35
Tue.	3	No L.	No L.	4.45	5.35
Wed.	4	No L. FM	No L.	4.45	5.35
Thu.	5	No L.	No L.	4.40	5.45
Fri.	6	5.20 PM	7.20 PM	4.40	5 45
Sat.	7	5 20	8.10	4.40	5.45
Sun.	8	5.20	9.10	4.40	5.45
Mon.	9	5.20	10.10	4.40	5.45
Tue.	10	5.20	11.10	4.40	5.45
Wed.	11	5.20 LQ	12.20 AM	4.40	5.45
Thu.	12	5.20	1.30	4.30	6.00
Fri.	13	5.20	2.40	4.30	6.00
Sat.	14	5.20	3.40	4.30	6.00
Sun.	15	5.10	5.50	4.30	6.00
Mon.	16	5.10	5.50	4.30	6.00
Tue.	17	5.10	5.50	4.30	6.00
Wed.	18	5.10 NM	5.50	4.30	6.00
Thu.	19	5.10	5.50	4.25	6.00
Fri.	20	5.10	5.50	4.25	6 00
Sat.	21	5.10	5.50	4.25	6.00
Sun.	22	5.10	6.00	4.25	6.00
Mon.	23	7.40	6.00	4.25	6.00
Tue.	24	8.40	6.00	4.25	6.00
Wed.	25	9.30	6.00	4.25	6.00
Thu.	26	10.30 FQ	6.00	4.20	6.10
Fri.	27	11.30	6.00	4.20	6.10
Sat.	28	12.20 AM	6.00	4.20	6.10
Sun.	29	1.20	6.00	4.20	6.10
Mon.	30	2.20	6.00	4.20	6.10





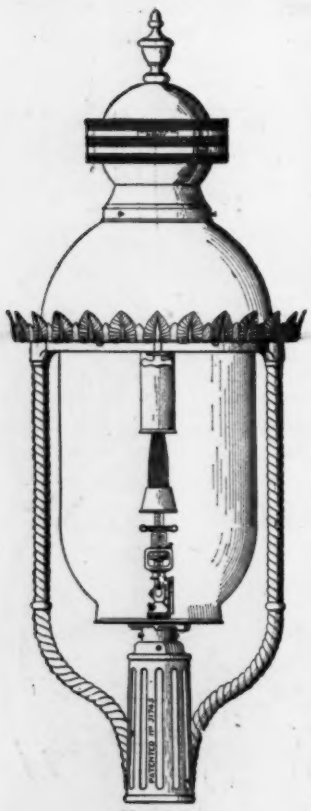
TOTAL HOURS LIGHTING DURING 1903.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	245.00	January	423.20
February	192.00	February	355.25
March	201.00	March	355.35
April	167.20	April	298.50
May	152.00	May	264.50
June	131.00	June	234.25
July	140.40	July	243.45
August	156.20	August	280.25
September	171.20	September	321.15
October	198.20	October	374.30
November	216.30	November	401.40
December	232.10	December	433.45
Total, yr.	2203.40	Total, yr.	3987.45

NEW YORK, 33 Nassau Street. PHILADELPHIA, Broad and Arch Streets. CHICAGO, Foot of Orleans Street. BOSTON, 624 Tremont Building.
CLEVELAND, 809 Cuyahoga Building. ST. LOUIS, 712 Roe Building. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

AN underlying principle in business is to show an increase each year---to grow. The astute dealer not only seeks to retain this year's customers, but to attract new trade next year.

The formula is simple-

THIS SHIELD IS THE WELSBACH TRADE MARK.

IT IS A GUARANTEE AND A PROTECTION.

Sell The Welsbach Brands.

The imitation stuff is bad for the customer---which is bad for you.

The genuine Welsbachs---Burners or Mantles---make satisfied customers---keep customers---MAKE NEW ONES.

And your profit isn't merely dollars and cents.

WELSBACH CO.,

Broad and Arch Sts., PHILADELPHIA.

THE UNITED GAS IMPROVEMENT COMPANY

For the Months Ending October 15, 1903, has been Awarded Contracts in the Following Places for

Standard Double-Superheater Lowe Water Gas Apparatus.

Rochester, N. Y.	Hempstead, N. Y.	Allentown, Pa.
Baltimore, Md.	Chester, Pa.	Savannah, Ga.
Chicago, Ills.	Lynn, Mass.	New York (Central Union Co.)
Amesbury, Mass.	Newark, N. J.	Cicero, Ills.
Aberdeen, S. D.	Washington, D. C.	Chicago (Ogden Co.)
Winsted, Conn.	Boone, Ia.	Easton, Pa.
Canon City, Col.	Pueblo, Col.	Lawrence, Mass.
Schenectady, N. Y.	Charlotte, N. C.	Council Bluffs, Ia.
Hagerstown, Pa.	Fall River, Mass.	Chattanooga, Tenn.
Malden, Mass.	Duluth, Minn.	Tuckerton, N. J.
Bridgeport, Conn.	New York (Mutual Co.)	Springfield, O.
Albert Lea, Minn.	Waltham, Mass.	Easton, Pa. (2d contract).
Brooklyn, N. Y.	Dover, Del.	Mobile, Ala.

TOTAL DAILY SETS TO OCTOBER 15, 1903, ... 55
TOTAL DAILY CAPACITY, ... 56,600,000 cubic feet.
TOTAL SETS TO DATE, ... 502
TOTAL DAILY CAPACITY, ... 356,280,090 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

OFFICE AND WORKS:
88 VAN DYKE ST., BROOKLYN, N. Y.
MANUFACTURERS OF

CLAY GAS RETORTS & SETTINGS, GENERATOR LININGS. SPECIALTIES.

Established 1854. Incorporated 1869.

LACLEDE
Fire Brick Manufg. Co.,

Manufacturers of { GAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Proprietors for the U. S., Coze System of Inclined Benches.

Estimates Furnished on Application for Most Successful Style of Construction.

Also for Free-Firing and Full and Half-Depth Regenerative Benches, for Burning either Coal or Coke in the Furnaces.

Office:
Cor. Manchester and Sulphur Avenues, St. Louis, Mo.

Established 1845. Reorganized 1902.

The Kreischer Brick Mfg. Co.,

Manufacturers of the very best quality of Clay Retorts, Blocks, Tiles, Settings and Firebrick of every description.

Also Miners and Shippers of Fireclay, Fire Sand, Ground Brick in Barrels.

WORKS: KREISCHERVILLE, STATEN ISLAND.
OFFICE: 119 E. 23D STREET, NEW YORK CITY.

Adam Weber Sons.

Works, Weber, N. J.
Main Offices, Park Row Bldg., New York

Modern Recuperative Furnaces.

Standard Fire Brick and Gas Retorts.

OSCAR B. WEBER'S

Construction Vertical 8's (Patented), First Instalment in the World with Modern Charging and Discharging Machinery.

AGENTS FOR

GRAHAM, MORTON & CO.,
LEEDS, ENGLAND,
INCLINED RETORT SYSTEM.

BUILDERS AND DESIGNERS OF

Perforated Radial Block Chimneys.

ISAAC C. BAXTER, President.
Works.
LOCKPORT STATION, PA.

ESTABLISHED 1864.

JAMES GARDNER, JR., CO.,

Successor to WILLIAM GARDNER & SON.

PETER YOUNG, Sec'y and Treas.
Address all communications to
JAMES GARDNER, JR., CO., Room 202 Lewis B'l'dg.
PITTSBURGH, PA

Fire Clay Goods for Gas Works.

HENRY MAURER & SON,
(ESTABLISHED 1856.)
EXCELSIOR FIRE BRICK & CLAY
RETORT WORKS
WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,
BENCH SETTINGS,
Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. Galesburg, Ills., or Buffalo, N. Y.
In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD, Galesburg, Ills.

For orders East of Buffalo, N. Y., or Pittsburg, Pa., freight will be paid to these points.

The Gas Engineer's Pocket-Book,

By HENRY O'CONNOR.

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

PRICE, $3.50.

For Sale by

A. M. CALLENDER & CO., 42 Pine Street, New York City.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec.
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE
RETORT & FIRE BRICK CO.

MANUFACTORY AT
LOCUST POINT, BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY, AND FIRE CEMENT.

Our Improved Half and Full Depth Benches have been Adopted by Many Gas Companies.

WALDO BROS., 102 MILK ST., BOSTON, MASS.

Sole Agents for New England States.

JOHN DELL,
President and General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

MANUFACTURERS OF

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are the **Exclusive Agents** *for the* **Mitchell Patent Benches,** *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* **Rear Clinkering.** **The Mitchell** *is the* **Original Coal Firing Bench.** *We also Erect Plain Benches with* **One** *to* **Six Retorts.**

YOUR CORRESPONDENCE IS RESPECTFULLY SOLICITED.

City Office:
411 Olive Street,
Continental Bank,
ST. LOUIS, MO.

CHRISTOPHER CUNNINGHAM,

PROPRIETOR,

THE NOVELTY STEAM BOILER WORKS,

BROOKLYN, N. Y.

STORAGE TANKS FOR GAS WORKS.

To Retain Fluid Material of Any Sort.

PIPING IN AND AROUND GAS WORKS.

Work Done for Several of the Largest Gas Companies in America, Stands as Reference.

Bronder Patent Stoking Machinery.

Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y., Toronto and Montreal, Canada.

Four-Scoop and Four-Rake Charging and Discharging Machines are being furnished for Detroit, Mich.

These are the only machines that will draw or charge simultaneously three or four retorts (vertically) and handle from 42 to 60 retorts in from 25 to 30 minutes, lid opening and closing and filling of furnaces included.

Hot Coke Conveyor, Quencher and Steam Exhauster, operating in Toronto, Can., working in water-sealed flue, rollers being protected from heat and grit.

COAL CRUSHERS, CONVEYORS AND BINS. TURNTABLES FOR MACHINES.

Labor-Saving Machines for Handling Coal and Coke from Coal Cars to Coke Yard or Bins, a Specialty.

G. A. BRONDER,

Contracting Engineer and Builder,

229 BROADWAY, NEW YORK.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING:

Ocean Mine Youghiogheny Gas Coal,
Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK. PHILADELPHIA, BALTIMORE AND NORFOLK.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

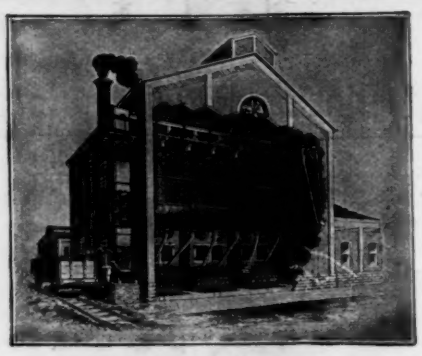
STRICTLY High Grade. . . . .
Carefully Prepared.
For Gas Making or
Heavy Steaming. .

A. C. M. AZOY, General Agent, 1 Broadway, New York.

JEFFREY COAL AND ASHES HANDLING MACHINERY.

MAY WE SEND YOU A COPY OF OUR CATALOGUE?

Shaking Screens.
Dump Cars.
Chains, all styles and sizes.
Elevator Buckets.
Sprocket Wheels.
Coal and Coke Crushers.
Elevators of all kinds.



Power Transmission Machinery.
Cable Conveyors.
Spiral Conveyors.
Rubber Belt Conveyors.
Conveyors of all kinds.

A Most Complete Installation, Including Crusher, Combined Elevator and Conveyor with Storage Tank. Capacity, 500 Tons of Coal.

We are prepared to handle your material rapidly and economically, in Bulk or Package, Wet or Dry, Hot or Cold, Up, Down, Straight Along, Sidewise, Any Size, Any Distance.

Address, THE JEFFREY MANUFACTURING COMPANY,
COLUMBUS, OHIO, U. S. A.
New York, Denver, Buffalo, Philadelphia, Butte, Mont., Kansas City, St. Louis, New Orleans, Mobile, Pittsburg, Charleston, W. Va.

The Gas Engineer's Laboratory Handbook,

By JOHN HORNBY, F.I.C. Price, $2.50.

Orders may be sent to

A. M. CALLENDER & CO., 42 Pine St., N. Y.

COAL TAR
— AND —
AMMONIA.

Third and Enlarged Edition.

BY
GEORGE LUNGE, Ph.D.

Price, $15. For Sale by
A. M. CALLENDER & CO.,
42 Pine Street, New York City.

ELECTRIC GAS LIGHTING.

How to install electric gas igniting apparatus, including the jump spark and multiple systems for use in houses, churches, theaters, halls, schools, stores or any large building. Also, the care and selection of suitable batteries, wiring and repairs.

By H. S. NORRIE.

Price, 50 cents. Orders may be sent to
A. M. CALLENDER & CO., 42 PINE ST., N. Y CITY.

HUGHES' "GAS WORKS,"
Their Construction and Arrangement, and the Distribution of Coal Gas.
Originally written by SAM'L HUGHES, C.E. Rewritten and much enlarged by WM. RICHARDS, C.E.
Eighth Edition, Revised, with Notices of Recent Improvements. Price, $1.65.
A. M. CALLENDER & CO., 42 PINE ST., N. Y. CITY.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

Do You Wish to Know

what size of pipe to use to convey any quantity of gas, any distance, with any loss of pressure and any initial or final pressure? Then use

Cox's Gas Flow Computer,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50.
For sale by
A. M. Callender & Co., 42 Pine St., N. Y.

POOLE ON FUELS.

THE CALORIFIC POWER OF FUELS.

By HERMAN POOLE, F.C.S.

Second Edition. Price, $3. For Sale by

A. M. CALLENDER & CO., 42 Pine St., N.Y. City.

BINDER for the JOURNAL.

Price, $1.00.

A. M. CALLENDER & CO., 42 Pine Street, N.Y.

Edmund H. McCullough, President. Chas. F. Godshall, Treasurer. H. C. Adams, Secretary. Henry Wharton, Assistant Secretary.

THE WESTMORELAND COAL CO.

Chartered 1854.

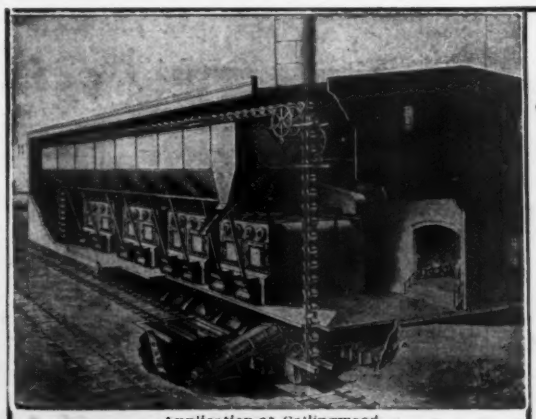
Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.,
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.



Application at Collingwood.
Shops L. S. & M. S. R. R., Cleveland, O.

LINK-BELT

Overlapping

PIVOTED BUCKET CARRIER.

(PATENTED.)

A single machine will handle both coal and ashes in boiler room. It is automatic, efficient, durable, occupies little space, and saves money. Can be adapted to a wide range of special conditions. : : : : : : :

Link-Belt Machinery Co.,

LINK-BELT ENGINEERING CO., Philadelphia. Chicago.

THE SUN OIL CO.

Crude Oil, Gas Naphtha,
Refined Petroleum, Gas Oil.

Toledo, O., and Pittsburgh, Pa.

Standard Oil Company,

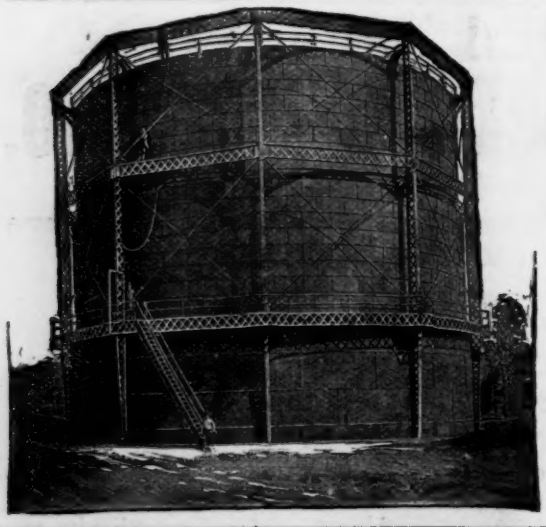
GAS NAPTHA DEPARTMENT.

GAS NAPTHA.

GAS OIL.

Correspondence Solicited.

26 Broadway, New York City.



DAVIS & FARNUM MFG. CO.,

WALTHAM, MASS.

Principal Office & Works, Waltham, Mass. Boston Office, R'm 18, Vulcan Bldg., 8 Oliver St.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

BAXTER & YOUNG,

CONTRACTING AND CONSULTING GAS ENGINEERS.

Examination and Values Ascertained of Artificial and Natural Gas Properties.

COMPLETE GAS WORKS ERECTED.

Artificial and Natural Gas Mains Furnished and Laid.

GAS PROPERTIES PURCHASED.

OFFICE: WAYNE COUNTY BANK BUILDING,

Rooms 201 & 202. **DETROIT, MICH.**

A. E. BOARDMAN, C. E.,

Consulting and Contracting Engineer.

Particular attention given to Gas, Water and Electric Plants. Long and successful experience with the problem and practice of

Filtration for Public Water Supply.

Edison Building, 42 and 44 Broad St.,

NEW YORK CITY.

DAVID LEAVITT HOUGH,

Consulting Engineer

AND

CONTRACTOR,

PARK ROW BUILDING, N. Y.

Geo. Shepard Page's Sons.

GAS MACHINERY.

Correspondence Solicited.

180 Fulton Street, New York City.

Established 1876.

National Paint Works.

SPECIALISTS IN PAINTS FOR METAL SURFACES.

We Sell 60 Per Cent. of the Gas Companies of the U. S. their Paint. "Nuff said."

Great Northern Bldg., Chicago. Williamsport, Pa. 92 William Street New York City.

KERR MURRAY MANUFACTURING COMPANY,

Engineers and Manufacturers

APPARATUS FOR COAL GAS PLANTS,

SINGLE AND DOUBLE-LIFT GASHOLDERS AND STEEL TANKS,

Latest Improved

ROTARY EXHAUSTERS, P. & A. TAR EXTRACTORS, AMMONIA WASHERS,

CONDENSING, SCRUBBING AND PURIFYING APPARATUS.

Street Specials and Valves.

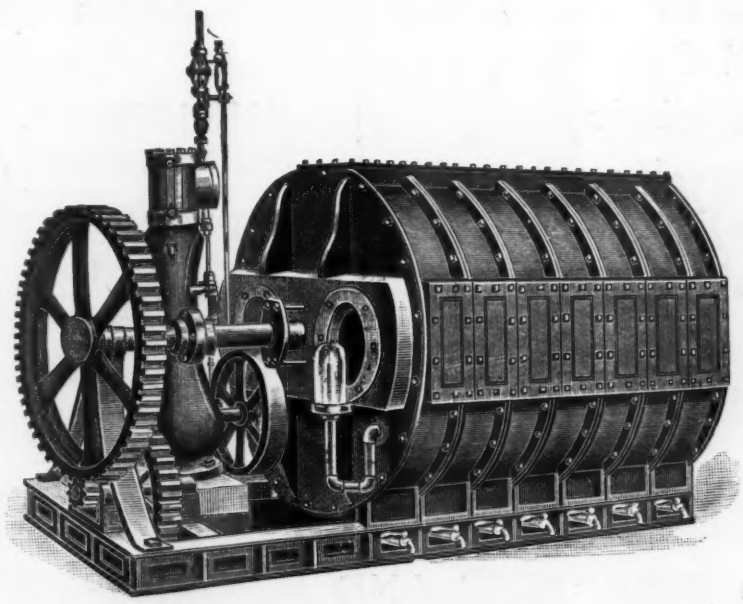
ADDRESS:

KERR MURRAY MANUFACTURING COMPANY, FORT WAYNE, IND.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Designers and Builders of Gas Works.



Sole Lessees the Wilkinson Water Gas Process.

PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Discs, thus reducing the weight on shaft and power for operating same.

Coal and Water Gas Installations of the Most Modern and Complete Types.

BENCHES WITH INCLINED RETORTS.

System Stettiner Chamotte Fabrik, Actien Gesellschaft, of Stettin, Germany.

GASHOLDERS OF ALL SIZES.

General Western Agents, THE LLOYD CONSTRUCTION CO., of Detroit, Mich.

QUINTARD IRON WORKS,

N. F. PALMER,

Foot of 12th St. & East River, New York,

MANUFACTURERS OF

GAS APPARATUS.

Complete Works Erected.

FREDERICK W. FLOYD, Engineer.

ALEX. C. HUMPHREYS, M. E., M. Inst. C. E. ARTHUR G. GLASGOW, M. E., M. Inst. C. E.

HUMPHREYS & GLASGOW,

BANK OF COMMERCE BLDG., 31 Nassau Street, New York.

38 VICTORIA STREET, London S. W., England.

CONSULTING GAS AND ELECTRIC LIGHT ENGINEERS.

PROPERTIES PURCHASED.

COMPLETE EXAMINATIONS MADE.

R. D. WOOD & CO.,

400 CHESTNUT ST., PHILADELPHIA,

MANUFACTURERS OF

Cast Iron Pipe.

HEAVY LOAM CASTINGS,

Dunham Specials,

Hydraulic Work,

LAMP POSTS, VALVES, ETC.,

Gas Power Plants with Producers.

BUILDERS OF

Gasholders.

Single, Double and Triple Lifts, with or without Metal Tanks.

PURIFIERS, CONDENSERS, SCRUBBERS, BENCH WORK.

Cutler's Patent Freezing Preventer for Holder Cups.

ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

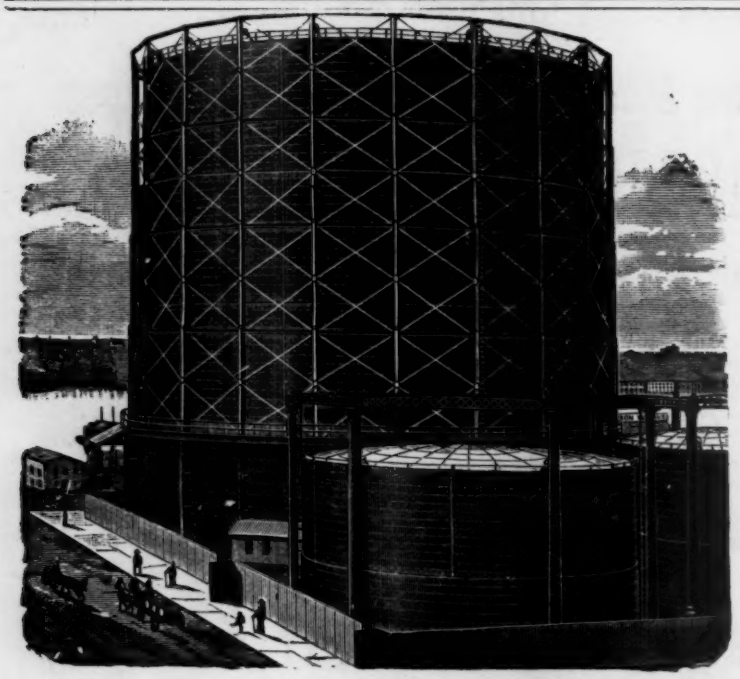
FOUNDERS AND MACHINISTS.

MANUFACTURERS OF

All Ironwork and Machinery Required in a Gas Plant.

Estimates, Drawings and Specifications furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

245 Broadway, New York City. OFFICES **Bridge & Ogden Sts., Newark, N. J.**



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN R. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

West and Calyer Sts. (Near 10th & 23d St. Ferries)
NEW YORK, Borough of Brooklyn.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

STEEL GAS HOLDER TANKS.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

THE GAS ENGINEER'S LABORATORY HANDBOOK,

By JOHN HORNBY, F.I.C.

PRICE, - - - - - - - $2 50.

A. M. CALLENDER & CO., No. 42 Pine Street, New York City.

THE STACEY MANUFACTURING CO.,

MANUFACTURERS OF

Gasholders, Steel Tanks,

AND ALL IRONWORK & MACHINERY REQUIRED IN A GAS PLANT.

ALSO THE ONLY AUTHORIZED MANUFACTURERS OF

The Chollar System of Gas Purification.

OFFICES:

No. 239 Mill Street, CINCINNATI, OHIO. 'Phone, West 690.

PLANS, SPECIFICATIONS AND ESTIMATES CHEERFULLY FURNISHED.

RITER-CONLEY MFG. CO.,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. EASTERN OFFICE: 39-41 Cortlandt St., New York City.

WM. HENRY WHITE,

EDISON BUILDING, No. 44 BROAD STREET, = = = NEW YORK CITY,

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

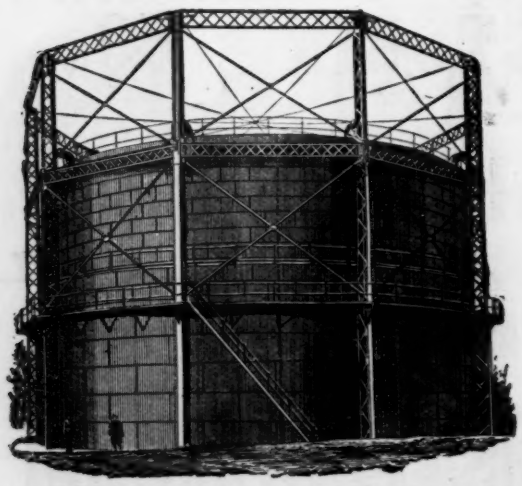
Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited.
Plans and Estimates Furnished.

1903 DIRECTORY 1903

OF AMERICAN GAS COMPANIES.

Price, - - - - - - - - - $5.00.

A. M. CALLENDER & CO., - - No. 42 Pine Street, New York.



1842 ※ Deily & Fowler, ※ 1903

LAUREL IRON WORKS.

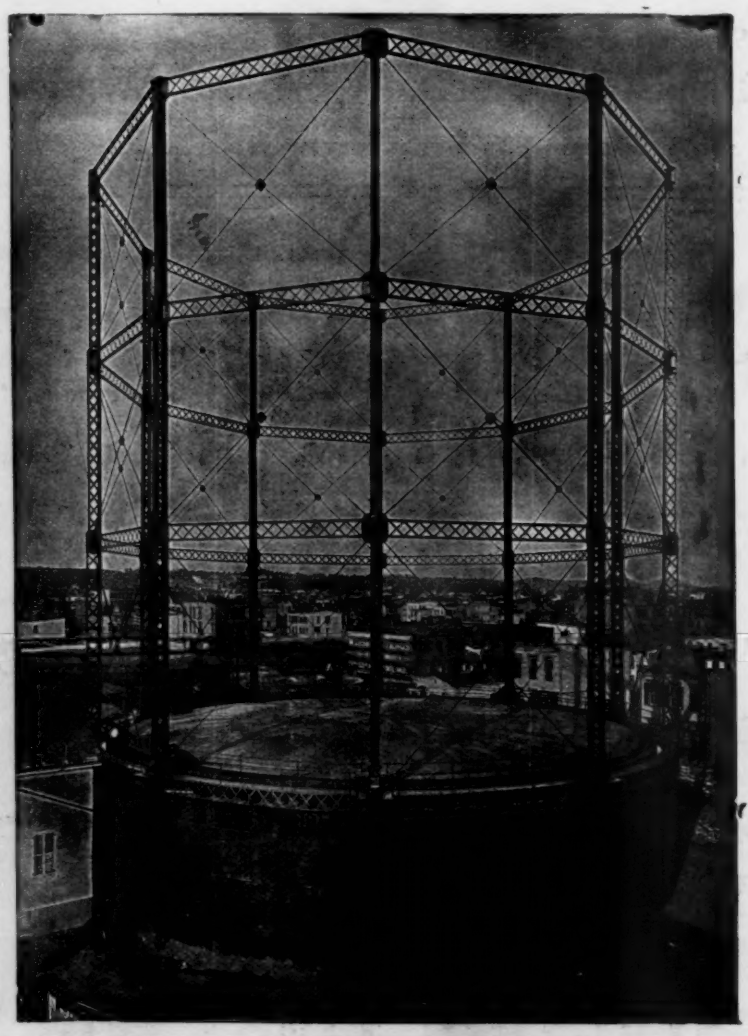
Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.



The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 Cu.Ft.

LOGAN IRON WORKS,

Brooklyn, N. Y.,

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

Complete, with Steel Tanks.

BENCHES, SCRUBBERS,
CONDENSERS,
PURIFIERS, IRON ROOFS,

AND ALL PARTS OF

GAS WORKS APPARATUS.

Contractors for Complete Works.

Gas Analyst's Manual,

By JAQUES ABADY, M. Inst. Mech. E.

(Incorporating F. W. Hartley's "Gas Analyst's Manual" and "Gas Measurement.")

Ninety-three Illustrations and Nine Folding Plates.
Bound in Handsome Half Leather. Price, - $6.50.

FOR SALE BY

A. M. CALLENDER & CO., - - 42 Pine Street, New York City.

Established 1854.

D. McDONALD & CO.,

MANUFACTURERS OF

WET AND DRY METERS, STATION METERS AND METER PROVERS.

ALSO MAKERS OF

THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

WE HAVE MADE AND SOLD IN THE UNITED STATES

OVER 120,000 OF THESE METERS,

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

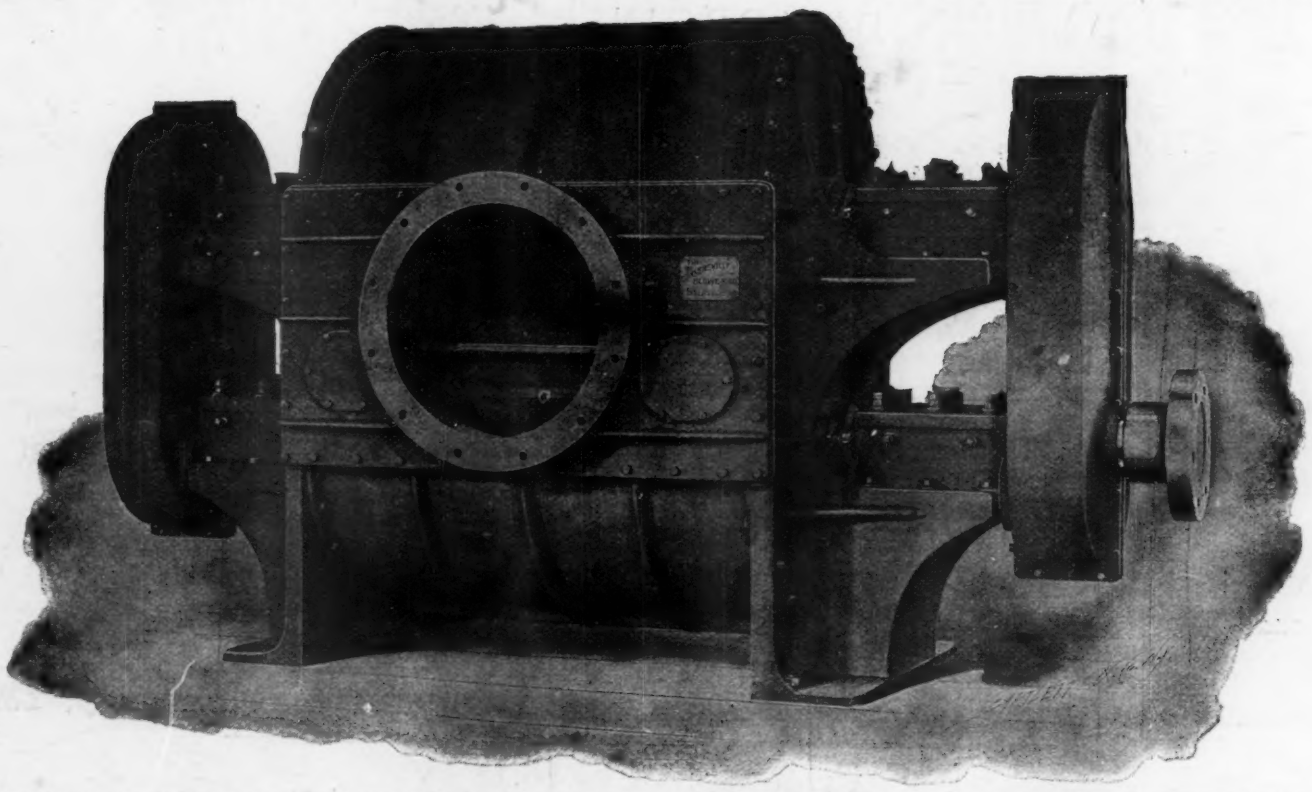
Correspondence Solicited.

561 West Forty-seventh Street, NEW YORK. | 51, 53 & 55 Lancaster Street, ALBANY, N. Y. | Jefferson and Monroe Streets, CHICAGO.

THE CONNERSVILLE BLOWER CO.,

MANUFACTURER OF

ROTARY POSITIVE PRESSURE GAS EXHAUSTERS, BLOWERS AND PUMPS.



HORIZONTAL OR VERTICAL, IN CAPACITY RANGING FROM 9,000 to 1,800,000 CU. FEET DISPLACEMENT PER HOUR.

CONNERSVILLE BLOWER CO., Connersville, Ind. EASTERN SALES OFFICE: 95-97 Liberty St., New York City.

NATHANIEL TUFTS METER CO.,

ESTABLISHED 1849.

8 MEDFORD STREET, BOSTON, MASS.

Consumers' Dry Gas Meters.
Station Meters of Any Capacity.

PREPAYMENT GAS METERS.

MARYLAND METER CO.,

BALTIMORE, North and Saratoga Streets. **CHICAGO, 88 to 92 Jackson Boulevard.**

CONSUMERS' AND STATION METERS, PRESSURE GAUGES, ETC.

SPECIAL ATTENTION GIVEN TO ALL REPAIR WORK.

"Have you Seen our Complaint Meter?"

USING KEYSTONE METERS

IS FRAUGHT WITH NO DISAPPOINTMENTS.

PERFECTLY MADE.

PERFECT MEASUREMENT GUARANTEED.

THE KEYSTONE METER COMPANY,

ROYERSFORD, PA.

FIELD'S ANALYSIS
For the Year 1902.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 34th Year of Publication. Compiled and Arranged by

JOHN W. FIELD,

Secretary and General Manager of The Gas Light and Coke Company, London.

Price $5. For Sale by

A. M. CALLENDER & CO., - No. 42 Pine Street, N. Y. City.

AMERICAN METER COMPANY,

NEW YORK, PHILADELPHIA, CHICAGO,
SAN FRANCISCO, ST. LOUIS.

PREPAYMENT METERS.

THEIR CONSTRUCTION IS SUCH THAT THEY MAY BE READILY READJUSTED WHEN THE SCALE OF GAS RATES IS CHANGED.

HELME & McILHENNY,

Established 1848. 1339 to 1349 Cherry Street, Philadelphia, Pa.

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED.

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

FACTORY AT ERIE, PA.

THEODORE D. BUHL, President. CHARLES H. JACOBS, Secretary-Treasurer.

Detroit Meter Company,

DETROIT, MICH.

Manufacturers of . .

GAS METERS of the HIGHEST QUALITY

METER REPAIRING A SPECIALTY. SEND FOR OUR PRICE LIST.

Detroit is one of the best shipping points in the United States for prompt deliveries by rail or water to the East, West or South.

BUHL Meters will need few Repairs. We make our own Tin Plate. Trial Orders Solicited.

WESTERN GAS CONSTRUCTION CO.,
GAS ENGINEERS AND BUILDERS,
FORT WAYNE, IND.

Coal Gas Plants,
Water Gas Plants,
Oil Gas Plants,
Fuel Gas Plants.

Our apparatus is designed, manufactured, erected and operated under the personal supervision of our own engineers, thus giving buyers the advantage of experience covering every phase of gas enterprise. : : : : : :

The Western Gas Construction Company,
FORT WAYNE, IND.